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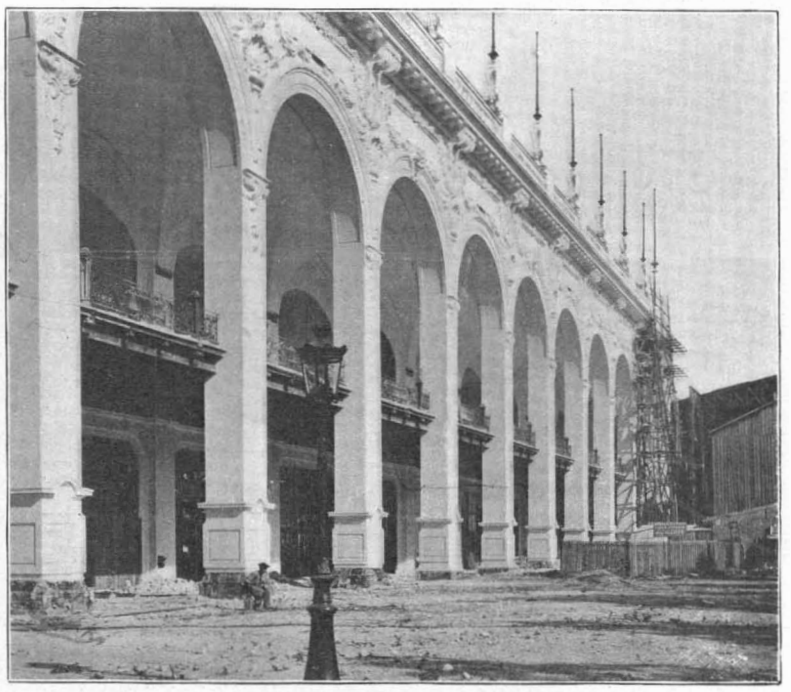
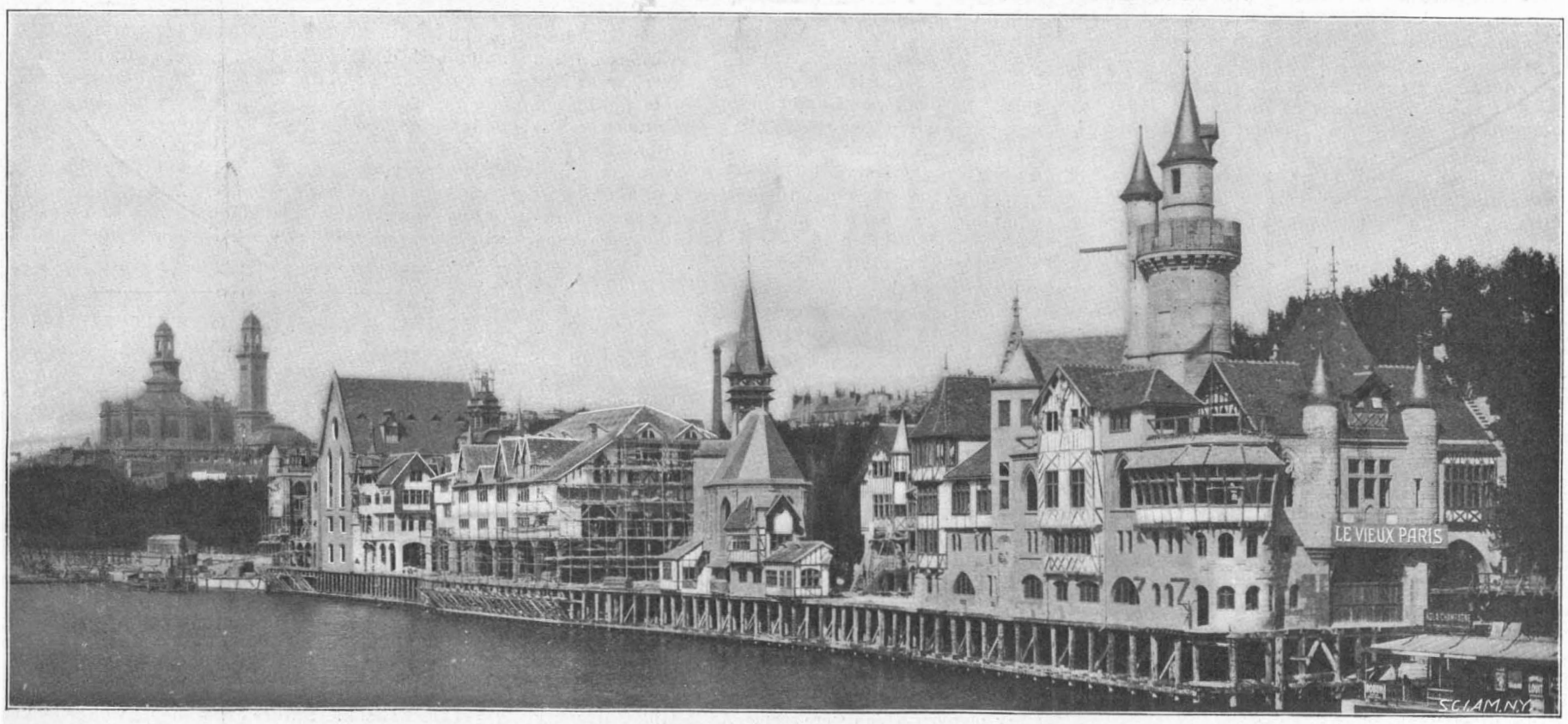
Palace of Ceramics and Glass.

Side of Grand Palace of Fine Arts.

Present Condition of Esplanade des Invalides.



Palace of Mines and Metallurgy, Champ de Mars.



Ancient Paris, on the Northern Bank of the Seine.

PRESENT CONDITION OF THE PARIS EXPOSITION OF 1900.—[See page 342.]

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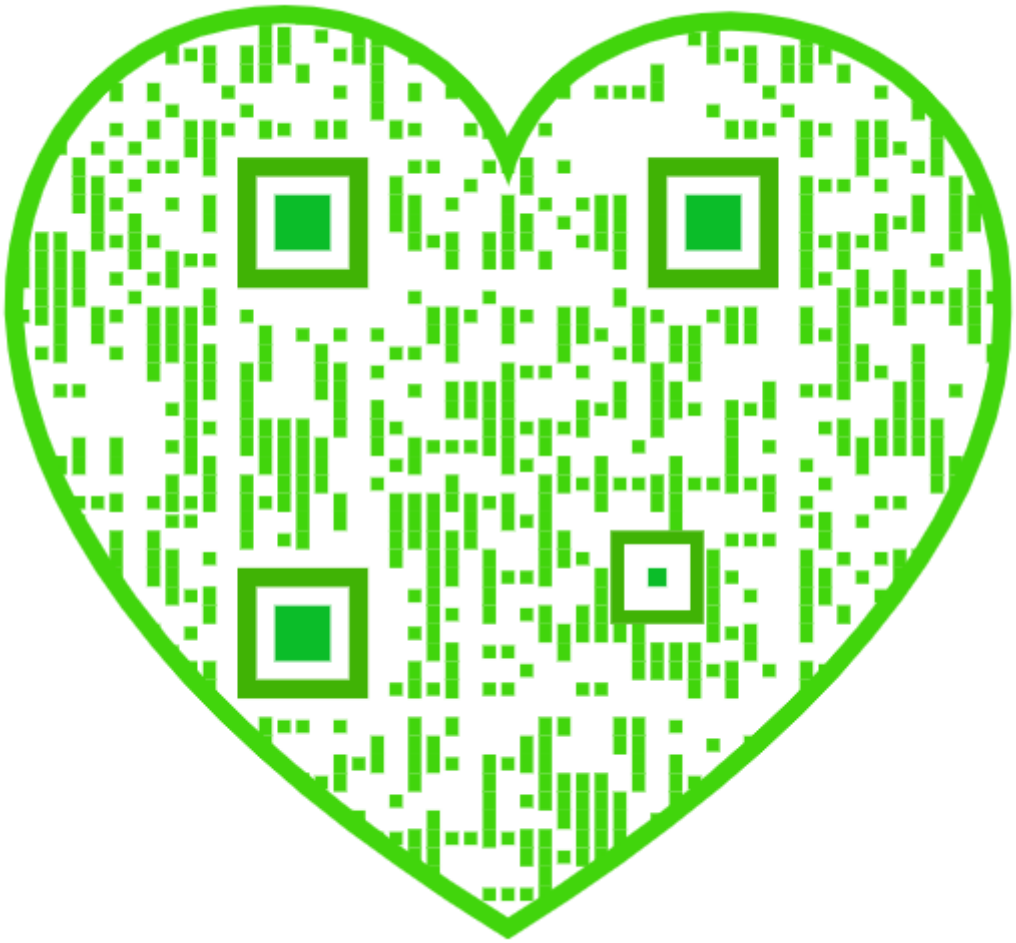

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NEW YORK, SATURDAY, NOVEMBER 25, 1899.

INDUSTRIAL INVASION OF GREAT BRITAIN.

It was a question only of time when the position of Great Britain as the greatest supply station for the engineering needs of the world would be challenged. In the past decade she has witnessed the steady inroads of American and Continental machinery upon territory which she had come to regard as exclusively her own, and now, in the closing years of the century, the industrial war has been carried into the tight little island itself with a vigor and persistency that cannot be gainsaid. The latest evidence of this is found in the successful tender of American firms for supplying the electrical equipment for the new system of tramways in the city of Glasgow. Coming so soon after the orders for American locomotives, and the widely advertised affair of the Atbara bridge, the Glasgow success has stirred up our British contemporaries to an acknowledgment of the serious nature of American and Continental competition.

The subject is discussed with much candor in a recent issue of The Electrician (English), which admits that without going beyond the consideration of electrical generating stations and tramways, it is evident that hardly a week passes without the news of a contract, often of considerable magnitude and importance, being awarded to an American or Continental firm of manufacturers, or its agents. Speaking of the colonial market, our contemporary is of the opinion that if the present tendency is not soon reversed, British machinery will in a very few years occupy the position filled by German machinery a quarter of a century ago, and it makes the rather startling statement that the amount of machinery sent over to the continent of Europe threatens to become small compared with that imported into Great Britain.

In endeavoring to explain the situation, manufacturers have been fertile in excuses. The great strike of 1897-98 has been blamed as the predisposing cause, since the accumulation of work prevented the home manufacturers from accepting contracts, which were thus given out in other countries. As a matter of fact, however, instead of increasing their plants, British manufacturers believed that the activity in electrical work was a temporary "boom," and made no effort to meet it. Another explanation is that English consulting engineers have driven electrical work abroad by their practice of specifying that only those firms need tender who have already gained experience in building the particular class of machine required. This, it is urged, has limited the bidding to firms whose workshops were already crowded with work. We are told, furthermore, that the suggestion has been put forward that as there is uncertainty as to the value of what are claimed to be the fundamental patents for polyphase systems, English manufacturers are doing well to avoid them. To this The Electrician very properly answers that such questions can be tested in the law courts, and that certainly they form no adequate reason for neglecting to take up a line of manufacture which in the nature of things must grow to vast proportions in the near future. Other causes that are named are the high rate of wages paid in Great Britain as compared with the Continent, though this, of course, cannot be applied to the United States, and the tyranny of the trade unions, whose constant and suicidal effort it is to limit the amount of work that is turned out by labor-saving machinery.

Now, while our contemporary allows that all of these excuses have more or less weight, it claims that they do not represent the true cause of the loss of Great Britain's manufacturing ascendency. This is to be found in the indifference of the manufacturers, who are lulled into a state of contentment and fancied security by the fact that their books are full of orders and their shops crowded with work. "The foreign and colonial markets are left alone almost entirely, and so long as sufficiently high dividends are earned, British manufacturing firms are happy in their own shortsightedness and supine as to the industrial future of their country."

There is much truth as regards the electrical field in the position taken by The Electrician. It is our opinion, furthermore, that the successful invasion of Great Britain by American manufacturers, not merely in electrical, but in steam engineering and the allied trades, is due to fundamental differences of character and methods. Where the British manufacturer is apt to be contented (as our contemporary explains) when his establishment is in the full swing of prosperity, his American brother is at all times keenly on the alert to seize every opportunity for enlarging the scale of his operations. In this restless energy, this conviction that no article is so good but it may be bettered, no operations so large but they may be extended, we find the promise of a future time when we shall dominate the industrial world as completely as Great Britain has done before us.

It is true we are an inventive people, and much of our success is due to this fact; though it is open to question whether we have not profited equally by our quickness to adopt the best inventions of others wherever they may originate, and carry them with a rush to their full development. The locomotive, the possibilities of the steam railroad, the bicycle, the Bessemer process and all the heavy trades that have sprung from it, received their full exploitation in this country. We rarely undertake the manufacture of an article without making it first cheaper and then better than our competitors; and unlike them we enlarge our facilities so as to keep well ahead of the demands of trade, being ready to sell from stock a locomotive or even a bridge, if the necessities of the case demand it.

BIDS FOR 16½-KNOT CRUISERS ACCEPTED.

The majority report of the Naval Board of Construction has rejected all the alternative plans presented by private firms for the new cruisers, and has awarded the six vessels to firms which bid upon the plans drawn up by the Construction Department. The rejected bids undertook to build, for practically the same price and in six months' less time, vessels of from 18 to 19 knots speed and 770 to 830 tons coal capacity, as against vessels of 16½ knots speed and 700 tons coal capacity.

In view of the fact that under the terms of the contract these six cruisers will be accepted at reduced price if they make as low a speed as 15½ knots, we think the country is warranted in demanding that the Naval Board shall explain why it has rejected bids for 18 to 19-knot vessels in favor of vessels which are distinctly inferior, in speed and coal capacity, and require six months more time to build.

We have read with great care everything of an official nature that has appeared in the way of an apology —it can be regarded as nothing less—for such an apparent retrogression in naval ideas as is involved in the construction of 15½ to 16½-knot cruisers in this age of high-speed vessels; but we are free to confess that no adequate reason has yet been offered for the extraordinarily low speed adopted for these vessels. If warship design is a compromise, we naturally look for some preponderance of battery, or coal endurance, or protection, to compensate for the deficiency in speed. But not only is there no preponderance in the features named, but in the matter of protection the ships are only less faulty than they are in speed.

THE METEOR DISPLAY.

The meteor display on November 14, 15, and 16 was disappointing. Unfavorable conditions hampered the astronomers at the Naval Observatory at Washington on the 14th; clouds prevented observations until 3 o'clock A. M., and it was only partially clear at any time. Paths of ten Leonid meteors were plotted on the star chart. One of these was as bright as a second magnitude star, but the others were fainter. The conditions at the Harvard Observatory were very unfavorable for observing the meteoric display. The efforts of the observers met with some success, however. On November 16 twenty meteors were seen about 5 o'clock A. M. at Chicago; the student watchers had an opportunity which was denied to the astronomers of the Yerkes Observatory. At the Flower Observatory of the University of Pennsylvania, Philadelphia, the watchers recorded 102 meteors, 69 of which were Leonids.

Nearly all the meteors observed were faint, only a few of them being of the second magnitude. Most of the non-Leonids were scarcely discernible. In no instance did a meteor leave a trail visible for more than a few seconds. The Harvard Observatory counted 64, but the display hardly came up to the expectations of the astronomers. Professor Howe, of the University of Denver, reported that he counted 18 Leonids besides a large number of meteors in other portions of the sky. On November 14 many students of Princeton stayed out long after midnight to observe them, and in order that all might have an opportunity of observing them, the bells in the town rang to wake up the students at one o'clock. No photographs were taken of the few stray meteors which were seen. At McGill University photographs of 156 meteors were obtained. At Lima, Peru, at half past 12 o'clock on November 15, there was a strong earthquake shock, but no celestial phenomena were observed. By the falling of an aerolite seven miles south of Crescent City, Ill., a residence was partly wrecked, tearing away a portion of the upper story. The aerolite buried itself in the ground about three feet from the foundation of the house.

In England a balloon made an ascension for the purpose of observing the Leonid shower. The observers saw only five meteors, and they were obliged to make a sudden descent, as the balloon was drifting toward the sea. As a result two of the three occupants of the balloon were injured. Generally speaking, the European observations proved a failure, except in the Austrian Alps, where, on November 15, no less than 300 Leonids were seen and photographed. One hundred were seen at Paris, and a fair display at Brussels.

The most interesting report received from the observations in the United States on November 15 is a dispatch, unsubstantiated as yet by astronomical authorities, to the effect that a large meteorite fell in the woods just east of Webster City, Ia. The dispatch said that the falling body came down with a terrific roar and, all seething and smoking, plowed out a hole in the ground 50 feet square. If the report is verified, the find will be more than usually interesting, because, while meteorites at times fall to the earth, it is not known that any of the Leonids have hitherto penetrated through the earth's dense atmosphere without being entirely consumed.

RAILROADS IN ASIA.

The lines of railway now existing in Asia form a total length of about 30,000 miles, of which two-thirds belong to British India. The portions of the Transcaspian and Transsiberian railways already constructed represent a length of 3,200 miles. In China, a number of European syndicates have obtained concessions for 3,600 miles of railroad, which will traverse regions which are rich in mineral and vegetable products; these lines are for the most part in course of construction. The Chinese government has about 300 miles of railway, these lines being very productive, especially that from Peking to Tientsin. Japan is well provided with railway communication, having 3,200 miles. French Indo-China has at present but 120 miles, but French possessions in Cochin-China, Annam and Tonkin will shortly have 2,400 miles, which will develop the mineral and agricultural resources of these countries. The Dutch Indies are well provided, Java alone having 1,000 miles. In British India the greatest length is to be found; here there are 21,000 miles of railway. As to Persia, there are as yet no railroads of any consequence, but Turkey in Asia possesses 1,500 miles, and 600 miles are in construction or projected.

REPORT OF THE BUREAU OF ORDNANCE.

Admiral O'Neil's report on the Naval Bureau of Ordnance, a digest of which is published in the current issue of the SUPPLEMENT, gives some interesting details regarding the power and performance of the new types of long-caliber guns. Such of these weapons as have been completed and tried at the proving grounds have given most satisfactory results, and there is every reason to expect that the high velocities which have been obtained in the smaller calibers will be approached in the large armor-piercing guns. The 12 inch gun is to be 40 calibers long and fire an 850-pound shell with a muzzle velocity of 2,800 foot-seconds and muzzle energy of 46,186 foot-tons. Its penetration at 3,000 yards will be 17·92 inches of Harvey armor. The new 6-inch gun of 50 calibers, with 2,900 foot seconds velocity, will have a muzzle energy of 5,838 foot-tons and at 3,000 yards will penetrate 5·3 inches of Harvey armor. The new 5-inch gun of 50 calibers is to have 3,000 foot-seconds velocity. Altogether, the Bureau is to be congratulated on the excellent results which have already been achieved or are promised in the early future.

WIRELESS TELEGRAPHY BETWEEN BALLOONS.

Experiments are being made at Vienna on the possibility of communication between balloons by wireless telegraphy, and they have met with some success. A captive balloon takes the place of the tall mast as used in the Marconi system. A copper wire is stretched between it and the earth, where the transmitting apparatus is placed. The second balloon, which ascends freely, carries the receiving instrument and is furnished with a wire 60 feet long hanging downward from the basket. The balloons received and transmitted messages up to a distance of six miles and at an elevation of about a mile. Of course, the great difficulty will be to establish a transmitting station in a free balloon, both on account of the weight of the necessary apparatus and also because there is danger of discharges from the powerful condenser so near the inflammable gas of the balloon. Future experiments will be looked for with interest by all who are engaged in making a study of wireless telegraphy.

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MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

BY WILLIAM H. HALE, PH.D.

The autumn meeting of the National Academy of Sciences was held at Columbia University, New York, beginning November 14. Prof. Wolcott Gibbs, president, in the chair.

In welcoming the Academy, President Seth Low, of Columbia, remarked that the preceding meeting at New York had been held five years ago in the old Columbia buildings on Forty-ninth Street, on which occasion the first award of the Barnard prize for scientific research was made. At the present meeting on the new site of Columbia, the second award is to be made.

Prof. Gibbs, replying, said that he came back to Columbia as an alumnus of fifty-eight years' standing.

The principal business of the fall meeting is the preparation of the annual report to Congress. Several papers were also read, some highly technical, others of sufficient general interest to justify an abstract.

Among the latter was an account by Prof. Ogden N. Rood, of Columbia, of his observations on color vision by means of his apparatus called the flicker photometer. The subject of color blindness has been much studied on account of the importance of rigid tests of vision of railroad men and others who have to distinguish colored signals. Prof. Rood finds, however, that even among persons of normal color vision different degrees of sensitiveness to different colors exist, so that no two persons have the same sensitiveness.

Prof. Edward C. Pickering sent a report of recent results of the Henry Draper memorial, read by Dr. Barker, giving a detailed account of discoveries by photography at Harvard and at the Arequipa Observatory in South America. Several new double stars have been discovered of two classes, those in which both components are luminous and those in which one is dark, the latter class being variable, because of the occasional interposition of the dark component.

Several of the double stars have periods of rotation less than two days, one being even less than thirty hours. In one of the second group the transition from minimum to maximum brightness occurs in two hours.

Dr. R. S. Woodward, of Columbia, has long been investigating the physics of the earth's atmosphere. He read a paper in which he stated that the atmosphere extends at the equator 26,000 miles beyond the earth, and at the poles 17,009 miles, thus taking a position intermediate between those who hold that it has no limit and those who place the limit within one or two hundred miles of the earth's surface. He also maintains that the old estimate of the weight of the atmosphere as equal to that of a shell of mercury 30 inches thick all round the earth is incorrect, and assigns as a maximum limit to the mass of the atmosphere $\frac{1}{1200}$ that of the earth and a minimum limit $\frac{1}{10000000}$—a very wide range.

In discussing the paper, Prof. Cleveland Abbé stated that old estimates of height of the atmosphere based on decrease of temperature of 1° C. for each 100 meters of elevation must be abandoned. The actual decrease is only 0·6° per 100 meters.

Dr. George F. Barker, who has recently returned from England, where he heard the lecture of Prof. Dewar, and saw his experiments with liquid hydrogen, gave an extremely interesting account of it, and exhibited a few of Prof. Dewar's vacuum tubes, prepared by liquid hydrogen, "which," said he, "Prof. Dewar was kind enough to give me, or I might rather say, I was audacious enough to steal."

Hydrogen is a limpid fluid, clear as water, but only of $\frac{1}{14}$ as much specific gravity, so that cork sinks in it as lead in water. It is intensely cold, having four times the frigorific potency of liquid air. The absolute temperature of it is only 21° above absolute zero, against 82° for liquid air. Air freezes and sinks in it.

Prof. Dewar dipped a brass cylinder into it, and then withdrew it, and showed upon the screen how the intensely cold cylinder liquefied the air of the room, which dripped from the cylinder.

Cotton dipped into the liquid hydrogen and then placed in a magnetic field shows magnetic affinities; but this is due to the liquefaction of oxygen from the atmosphere, as hydrogen is not itself magnetic.

Prof. Dewar's attempt to exhibit liquid hydrogen a year ago failed, for the very curious reason that the hydrogen contained about one-half of one per cent of air, which froze in the valves and clogged them so as to impede the action of the apparatus.

The vacua produced by liquid hydrogen are more perfect than by any other means, the pressure certainly not exceeding one-millionth that of the atmosphere. They are made by freezing out the gas contained in the vacuum tube. Prof. Barker exhibited samples prepared in tubes filled with several different gases. So perfect were the vacua that the electric spark would not pass through, and even the phosphorescence which characterizes high vacua was very faint.

When a vacuum is prepared from the air, everything less volatile than hydrogen is frozen out. This includes all the formerly recognized constituents of the air, and also the newly discovered argon; leaving only hydrogen, helium and neon. It is probable that hydrogen in minute quantity is always present in the air. This process will detect a gas which is present only in quantity of one-twelfth of one per cent. One of the tubes shown contained helium and hydrogen. A tube containing neon was included in the collection. Neon gives a spectrum of remarkable brilliancy, but the hall was not dark enough to exhibit the spectrum.

The other substances at one time supposed to be new constituents of the atmosphere, namely, metargon, xenon and krypton, are found to be either imaginary or one of them is a hydrocarbon.

Prof. E. W. Morley sent in a memoir of the late William A. Rogers as a physicist. Morley and Rogers were collaborators in the accurate determination of atomic weight of certain elements and in other physical researches.

Prof. Henry P. Bowditch gave a report of the conference at Wiesbaden for the purpose of organizing an international union of scientific societies, from which he has recently returned, the conference having been held in October.

Other papers were read on "The Time of Perception as a Measure of Difference in Intensity;" and on "Relations of Time and Space in Vision," by Prof. J. M. Cattell; (by invitation) "A Direct Proof of the Effect on the Eulerian Cycle of an Inequality in the Equatorial Moments of Inertia of the Earth," by Prof. R. S. Woodward; "The Definition of Continuity;" "Topical Geometry in General," and "The Map Coloring Problem," by Prof. Charles S. Pierce; and on "The Electro-Chemical Equivalents of Copper and Silver," by Prof. Theodore W. Richards, a new member of the Academy.

President Gibbs appointed a committee of five to award the Barnard medal to the man who, within the last five years, has made that discovery in physics or astronomy or in the application of science which shall be adjudged most valuable to the human race. The report and award will be made at the annual meeting at Washington next April. The previous award five years ago was to Lord Rayleigh for the discovery of argon, on which occasion an equal amount was raised and given to Prof. Ramsey for his share in the investigation.

A DISCUSSION OF THE SUPERIMPOSED TURRET FOR WARSHIPS.

It sometimes simplifies the discussion of a difficult and complicated question, particularly if it has to do with mechanical construction, if we reduce it to what we might call its simplest terms. While the question of the use of the superimposed or double-deck turret involves many considerations of structural economy of weights and parts, we think that the primary object may be set down as being the desire to obtain the greatest possible range of fire for the guns. Assuming that this is the case, let us suppose the case of a battleship whose whole armament consisted of two heavy guns carried within a turret which was placed amidships on the center line of the vessel, with the smokestack carried up through a cylindrical casing at the vertical axis of the turret, and let us suppose that apart from the turret and smokestack there was absolutely no other projection showing above the deck. In this case, and in this case alone, the ship's battery would have an absolutely unobstructed, all-round fire. Such a ship, if we remember rightly, was made the subject of a patent some ten or twelve years ago by one of the ex-chief constructors of the British navy.

A vessel of this kind, however, does not lend itself to the requirements of the modern battleship, in which it is desirable to have many guns of varying caliber, placed in gun positions as widely separated as the structural possibilities of the battleship will permit. As soon, however, as we commence to place the guns in separate turrets or casemates, we begin to sacrifice the arc of fire through which they can be trained, until some of the guns, such, for instance, as those which are placed in the broadside batteries, are limited to an arc of fire of 90 degrees. The distribution of the battery, the determination of the positions which give the greatest range for the largest number of guns, has been one of the most difficult problems in naval designing.

When the plans for the "Kentucky" and "Kearsarge" were under consideration, it was proposed by Lieut. Joseph Strauss, of the United States navy, to place one of the 8-inch turrets with its pair of guns upon the roof of each 13-inch turret and thereby secure in two 8-inch turrets the same concentration of fire ahead or abeam that was possible from four 8-inch turrets as installed on the "Oregon" type of battleship. The proposal met at first, but not latterly, with some opposition from a few officers of the line, and was received with more energetic opposition from the construction department. The first objection urged is that the system violates one of the first principles of battleship design, which is that the main armament should be as widely distributed as possible, so as to localize the injury resulting from a well-placed shot.

A structural objection urged against the system is that it concentrates a great amount of weight at one point and renders the problem of construction more complicated, besides aggravating the moment of inertia of the ship in a head sea, and subjecting the ship to special risks in docking. The "Kentucky" and "Kearsarge," however, have proved to be excellent sea boats.

Another objection is the tactical difficulty that the 8-inch and 13-inch guns, being mounted in the same turret, will at all times be trained upon one and the same part of a ship, whereas it would be desirable at close range to train the heavier guns upon the belt or barbettes and the lighter guns on the casemates or less heavily protected portions.

As against these objections it is urged by Lieut. Strauss that the risk of disablement, at least for the 8 inch guns, is greatly lessened by the fact that in place of the thinly armored barbette, the unprotected base and the light ammunition tube of the old system, these guns have now the splendid protection offered by having the massive turret and barbette armor of the big guns beneath them—a point which is certainly well made and goes far to offset the other objections above named. As regards the concentration of weight, it is pointed out that in consequence of the reduced thickness of modern armor, due to its superior quality, the entire weight of one double turret on the "Kearsarge" is only 947 tons as against 987 tons in the single turret 13-inch emplacement of the "Oregon."

The complexity of the ammunition supply, it is claimed, is avoided by having the ammunition hoist of the two 8-inch guns lead in a closed chute from the breech of the guns down through the 13-inch turret, passing between the guns to a separate handling room, which lies immediately below the 13-inch gun turret, and by having the ammunition for the 13-inch guns carried up from a handling room which is situated immediately below the handling room of the 8-inch turret. As to the tactical difficulty, it is urged that at the ordinary fighting ranges a warship presents so small a target that it would be impossible to select any particular part of the vessel for attack. Moreover, as the 8-inch guns of the "Kearsarge" can be fired two or three times while the 13-inch guns are being loaded, there will be, it is claimed, at close ranges, abundant time to use them on lighter parts of the vessel.

It is further to be remembered that by getting rid of the two complete turrets, their handling rooms, etc., there is a saving of 320 tons of weight, and that, as the barbette armor, training engines, etc., of the 13 inch guns now do double duty, there is a further saving of 140 tons, making a total economy of weight of 460 tons as compared with the use of separate turrets on the "Oregon." This is an enormously valuable feature which must commend itself strongly to the members of the construction department.

A further advantage is that the chief battery is reduced to two thoroughly protected positions, and that the absence of interference of one gun with another would enable a commander in going into battle to lay his ship in any desired position without considering the question of blast interference. Lastly, it is urged that the vulnerable target is smaller; although we think it is questionable whether this can fairly be mentioned as an advantage, since the target, when it is hit, will involve a wider range of destruction than would be possible in a single hit on either of the two separate turrets.

In conclusion, we would add that there is one feature which militates somewhat against the system and ought to receive mention in this connection. We refer to the fact that the firing of any one gun of the four is liable to be disconcerting to those who are sighting the other three. In two or four-gun turrets the guns are placed at a certain distance from the vertical axis, and the recoil at the instant of firing any one gun exerts a powerful turning moment about that axis, tending to swing the turret slightly to the right or left. It must be admitted that this is true of all turrets in which more than one gun is emplaced, but we think this interference with sighting may be somewhat aggravated in the case of a four-gun turret of the "Kearsarge" type.

The above consideration of this subject leads us to urge again that the government should make at the earliest practical opportunity a complete firing test of the main armament of the "Kearsarge," and we think that no time should be lost in taking her to sea for this special purpose. Unquestionably, Lieut. Strauss makes out a strong case in favor of the new system, but at the same time the objections are too numerous, and, if valid, too serious to be passed over lightly. There may be, moreover, unsuspected weaknesses in the system which could only be detected in the course of a long-sustained and severe trial.

In view of the fact that the Board of Construction has recommended the double turret for our latest battleships (although this action is not final) we trust that the Secretary of the Navy will see to it that the gunnery trials of the "Kearsarge" are pushed forward with all possible dispatch.

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NEW LETTER-BOX INDICATOR.

A San Francisco, Cal., inventor has produced a novel and complete time indicator for letter-boxes that will give assistance and information to the general public besides being of great benefit to the business world. This indicator is the invention of D. S. Richardson, superintendent of the San Francisco post office, together with others who have had much experience in this branch of the government service.

The indicator can be attached to any ordinary street letter-box, and will stand as much rough usage as the box itself. Regarding the construction of the indicator, its outer shell is a casting which takes the shape and dimensions of the front of the box to which it is attached. Its depth is about two inches, and its ornamental design adds to the symmetry and general appearance of the ordinary letter-box. A glass-covered slot, or window, about one by six inches, adorns the front. An endless chain, or belt, passes immediately behind this on the inside. The latter travels over the two rollers and carries the time announcements, which are displayed automatically and in regular sequence before the little window.

The mechanism is actuated by a crank and lever leading from a pawl and ratchet attachment to the upper roller down to the tray or drop door of the letter box. The rollers are set in motion by the simple act of opening the box, which carries the belt around just far enough to expose the next announcement or time of the next collection. The chain or belt is constructed so that it may be adjusted for any number of collections, and the card announcements may be easily changed to meet any requirements of the service. A very novel device has been introduced to overcome the difficulty resulting from the broken and irregular time of intervening Sundays and holidays for boxes from which collections are made from five to thirty times a day.

A box, for instance, from which twenty collections are made daily, will run automatically from Monday morning until Saturday night, or six full days. No attention whatever is required from the collector during that time. On Saturday night the collector moves a small lever which extends backward from the indicator into the main chamber of the letter box, and this throws an arm, very much like a railroad semaphore, directly across the slot opening, completely hiding the time announcement behind it. Any announcement may be printed upon the exposed arm of the semaphore, such as showing the Sunday collection hours, or else calling attention to the Sunday and holiday time as shown on an ordinary time card just below.

The act of throwing this semaphore into position disengages the gearing of the mechanism of the indicator without actuating the latter or moving the rollers. While the semaphore is up and exposed in the slot, the mechanism of the indicator is resting, holding itself in readiness for Monday morning and the next week's run. The last collector on Sunday night must throw down the lever, which was put up by the last collector on Saturday night, and then the hour of the first collection on Monday morning is in plain view in the slot. Not only does it show the collection hours, but also when each collection will reach the main post office or point of distribution, and when it will be sent out or dispatched from there to the trains or steamers. It makes each box a complete little bureau of information, besides acting as a check on the collector, and does away with the old method of detecting irregularities by means of decoys. The indicator always announces advance time, and is somewhat like a Bundy clock, telling its own story to the public and postal officials who may be acting as spotters to detect any lack of the faithful discharge of duties imposed on box collectors. The latter are required to make but two motions a week to make the indicator automatic in every detail, as the lever is thrown up on the last Saturday night collection and thrown down again on the last collection Sunday night. This duty is always to be performed about midnight and when the fewest number of men are on duty. The day collectors have no care in the matter whatever.

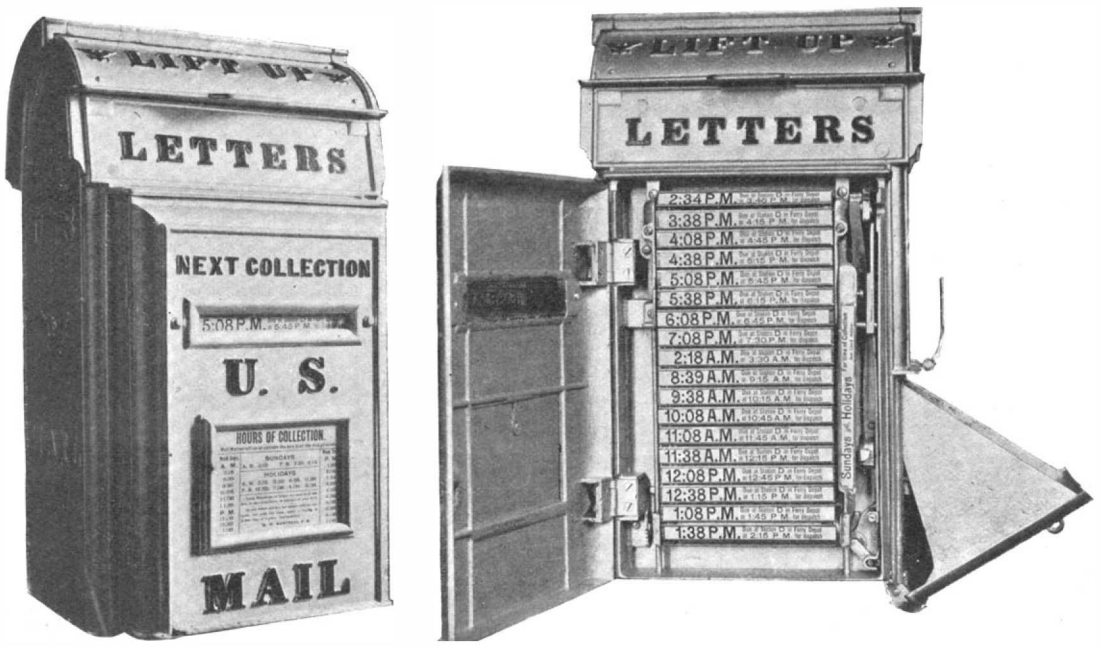
San Francisco, for example, has five mounted men who take up the night mail from the boxes throughout the entire city, and they would have to be charged with the duty of changing the arm or semaphore on Saturday and Sunday nights. Should they fail to do so, the first caller in the morning would discover it by the false time on the box. Its adoption does not call for the abandonment of any part of the present box equipment, it being designed for attachment to any box now in use by the government.

HERBERT I. BENNETT.

METHODS OF REVOLVING THE OPTICAL APPARATUS FOR LIGHTHOUSES.

BY COL. D. P. HEAP.

Whenever a stretch of coast is to be lighted, it is necessary to differentiate the lights from one another, so that the mariner may know positively where the lights visible to him are located, so that he may be able to properly lay his course. To do this various methods are possible: one by giving different colors to the lights, and another by some arrangement which will make the light invisible at determined intervals. The former method is accomplished by interposing red or in some rare instances green glass screens in front of the light; but it is objectionable, as the loss of light is respectively 75 and 80 per cent, and, especially when green glass is used, the color, under some conditions, is difficult to distinguish from the ordinary light.

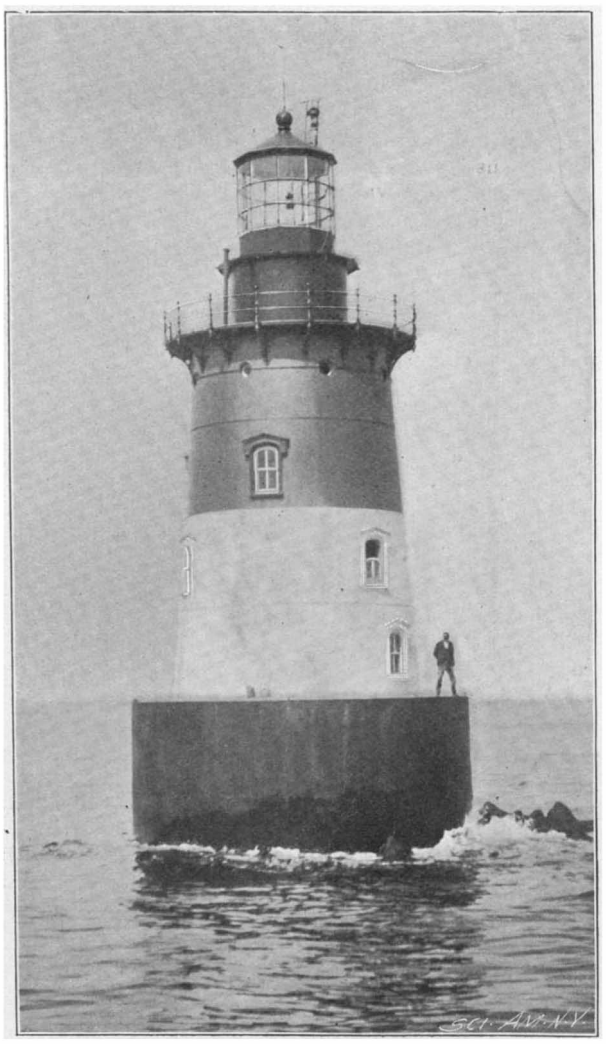


NEW TYPE OF LETTER-BOX BEING TESTED IN SAN FRANCISCO.

In the second method the light can be eclipsed by interposing an opaque screen moved at regular intervals by clockwork. During the obscuration, the light, of course, is lost, but this method has the advantage of economy and can be applied to any existing fixed light without affecting its range of visibility. A number of lights in Delaware Bay are so arranged.

The method which gives the most powerful light is to use an optical apparatus which will project a number of horizontal beams of light like the spokes of a wheel, and then to revolve the apparatus.

It is evident that the observer, wherever situated, will see as many flashes during one revolution of the apparatus as there are beams of light, and that these flashes will be separated by intervals of darkness. It is also evident that the power of these beams will vary inversely as their number; for example, if there are but two beams, each beam will be twice as powerful as if there were four; on the other hand, if the speed of revolution of the apparatus in each case is the same, the interval between flashes with two beams will be twice as great as if four were used, which is a serious defect when the speed of revolution is slow, as the mariner may have to wait one or even two minutes before he sees the flash, which is now the case in a number of the lighthouses in this country.



ROMER SHOALS LIGHTHOUSE, NEW YORK HARBOR.

Before the invention of the Fresnel lens, metallic reflectors were used. Mr. Thomas Stevenson describes a revolving light of this character in "Lighthouse Illumination," published in 1859. The following is an extract:

"The characteristic requirements of a revolving light are the alternation of light and darkness in every azimuth. In the catoptric system this is generally effected by means of a revolving frame, on which the reflectors are placed, each having its own lamp attached to it. Whenever, by the revolution of the frame, the axes of the reflectors are pointed to the eye of a distant observer, he receives the full effect of the light. From this description it is obvious that if the revolving frame has four, six, or eight faces, with one or more reflectors on each, as shown in plan and elevation, Figs. 1 and 2, there will be constantly illuminated four, six, or eight corresponding portions of the horizon; and as the frame that supports the reflectors which produce their corresponding beams of light revolves on its axis through 360°, the luminous patches will, in like manner, traverse along the distant horizon. The action of the optical agents in this instance must obviously differ from that required for fixed lights."

In this case the framework carrying the lights revolves around a central shaft, the power being applied by means of a bevel gear at *m*.

With the advent of the Fresnel lens now in use a special support became necessary. The first was known as the chariot and it is still largely in use. It consists of a steel ring supporting a number of wheels. The base plate of the lens rests on these wheels, which, in their turn, run on a steel track on top of the pedestal. Other wheels with vertical axes are in contact with the vertical collar and prevent lateral motion. This device answers well enough where slow speed is required, but there is too much friction developed when the speed is greater than one revolution per minute, especially with the heavy apparatus of the highest orders; moreover, the chariot wheels are expensive to manufacture, and the track on which they run soon becomes deteriorated.

The late Brig.-Gen. James C. Duane, when he was engineer of the third lighthouse district, devised a pivot to support lenses of the fourth order and smaller. This pivot, which was of hardened steel, rested on a hardened steel plate, both being submerged in oil. This materially reduced the friction, but the lateral motion had to be prevented by a shaft running in a brass collar, and there was considerable friction between the collar and shaft. In 1893 I substituted ball bearings for the pivots, but retained the collar and shaft, and thus did not reduce the friction as much as was desirable. The necessary speed of rotation had in the meantime much increased, in fact, the speed of rotation of a "lightning light" was not infrequently one complete revolution in ten seconds. To get this speed with lenses weighing as much as three tons supported on chariot wheels was impossible without increasing the power and size of the rotating apparatus beyond reasonable limits.

The French engineers, however, solved this problem in a most satisfactory manner by supporting the lens apparatus in a bath of mercury. This allowed the use of "feux eclairs," or "lightning lights."

I quote the following from a recent pamphlet of Mr. W. T. Douglas, M. Inst. C. E.:

"Such was the position of affairs when the invention of Mr. Bourdelles inaugurated a revolution the full extent of which has perhaps hardly yet been realized, for the "feux eclairs," with its mercury float rotation, has, wherever it has been adopted, commended itself to the approval of the maritime world. It is universally admitted that, sufficient power being granted, the fixed light is, from the point of view of visibility, the light par excellence. It is kept constantly in view, and a bearing can be taken from it and a course steered to it with absolute certainty when it is once picked

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up. The same statement could not be made with reference to a slow-revolving light; the periods of darkness are so long that the sailor is apt to lose patience, and if he happens to miss one or more flashes from any cause, as, for example, from the vessel falling into the trough of the sea, or from the obscuration of the light by masses of spray or even possibly by a passing vessel, his nerve may become unstrung, he wavers, and a disaster may result. Now this danger and difficulty the feux eclairs readily surmounts, as its lightning flash or flashes, occurring every five seconds with persistency, renders it for all practical purposes a fixed light, while it confers the further advantage of a positive characteristic."

The use of the mereury bath for rapidly revolving lenses of the 1st and 2d order seems at present to be a necessity. At least no satisfactory substitute has yet been found. The objection to it is its cost, while the objection to chariot wheels is the friction developed, and also their cost—though the latter is not so great as with the mercury bath system.

As ball bearings had been successfully used for thrust bearings, it occurred to me that they might be satisfactorily applied to lens apparatus of the fourth and fifth order whose weight is not excessive. After a series of experiments, I found that I could revolve apparatus of this kind at moderately fast speeds, say one complete revolution in twenty seconds. This allowed the use of lens apparatus with an increase in the size and dimension of the number of panels without prolonging the interval between flashes. For example, these intervals, with a four panel lens, need not exceed five seconds.

The use of the ball bearings necessitated an entire change in the pedestal supporting the lens, in the clock for revolving it, the method of raising it, and in the lamp. These changes are as follows: The pedestal (Fig. 5) consists of four wrought-iron pipes covered with brass tubing for a finish. These pipes are secured to a base ring which is to be screwed to the lantern floor and support a cast-iron plate. Below this is a brass plate on which the clock rests. The pedestal must be carefully leveled.

On the cast-iron plate is a brass cylinder, threaded to receive a collar, and on the cylinder is an iron plate on which the ball bearing plates rest. This method of construction brings the ball bearings as nearly as possible to the center of gravity of the lens. Another iron plate rests on the upper ball bearing plate, and on the former the lens is supported by three diagonal braces; this plate also carries the lamp. (See Fig. 5.)

The clock (Fig. 4) is regulated by a centrifugal governor. As the speed increases, the balls fly out and draw the disk on the left hand side of the clock to the right until this disk touches a small rawhide finger which can be moved back and forth by a screw; the farther this disk can travel, the greater will be the speed of the clock. The speed can be regulated to a nicety while the clock is in motion, which is not the case when fan governors are used.

The vertical spring on the left hand side has a brass finger which touches the disk when the clock is at rest, and by so doing makes an electric connection and rings a bell to warn the keeper that the clock has stopped; a switch is provided to open the circuit during the day.

The wire handle shown lying at base of clock in Fig. 4 can be secured around the groove in the lower ball bearing plate, and both plates and balls can be lifted out. The reverse of this process allows the ball bearings to be returned to their position and the lens made ready for use. The ball bearing plates and the balls are of the best tool steel, hardened, tempered and polished. The balls and grooves must be kept scrupulously clean and free from rust. When not in use the plates and balls are kept in a dust-proof brass box, the balls resting between two disks of chamois leather. A spare set of ball bearings and a spare governor are supplied with each apparatus. I find that there is less friction than with the mercury bath and the cost is less; the mercury alone for a fourth order lens costs about $100, while the cost of the ball bearings is $15 each.

The apparatus illustrated is a Chance Brothers fourth order flashing lens, three panels having been removed and replaced by silvered spherical reflectors. It is designed to make a complete revolution in 30 seconds and will give a flash of about ⅓ of a second duration every 10 seconds. A similar apparatus, but with six panels, is in successful operation at Romer Shoal Light Station, a view of which is herewith presented. It gives a flash every 4 seconds. I do not think that there is any other fourth order lens in our service with as short intervals between flashes.

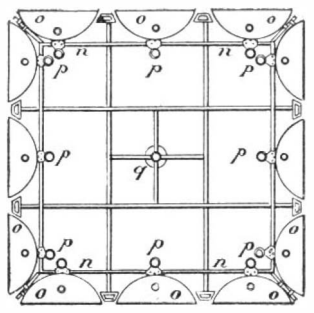

Fig. 1.

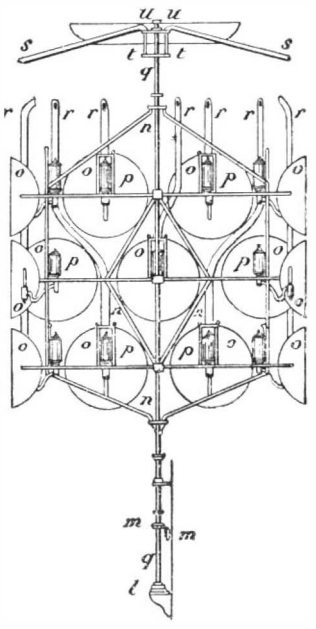

Fig. 2.

DIAGRAM OF REVOLVING LIGHT WITH METALLIC REFLECTORS.

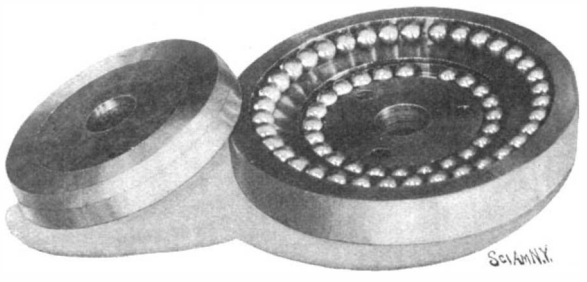

Fig. 3.—BALL BEARINGS FOR RAPIDLY REVOLVING LENSES.

The lower circle of balls carries the weight and the upper circle prevents lateral play.

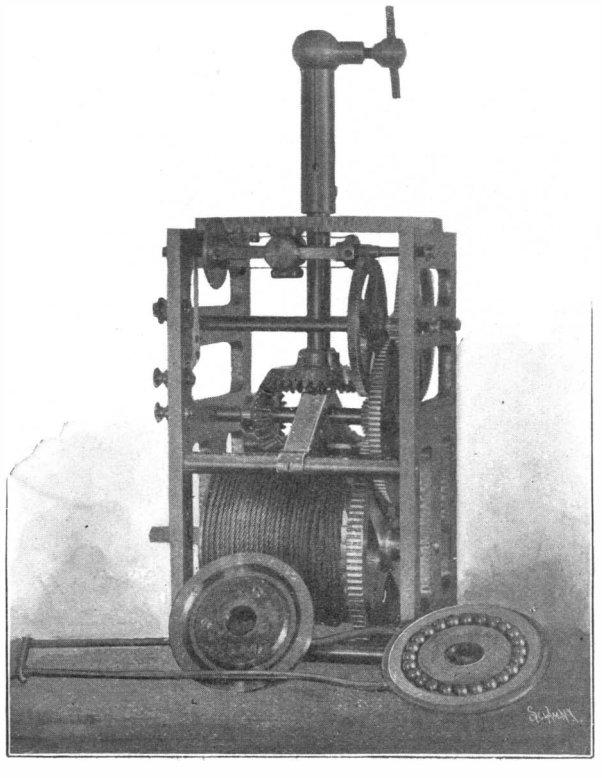

Fig. 4.—LAMP PEDESTAL AND CLOCK, SHOWING BALL BEARINGS REMOVED.

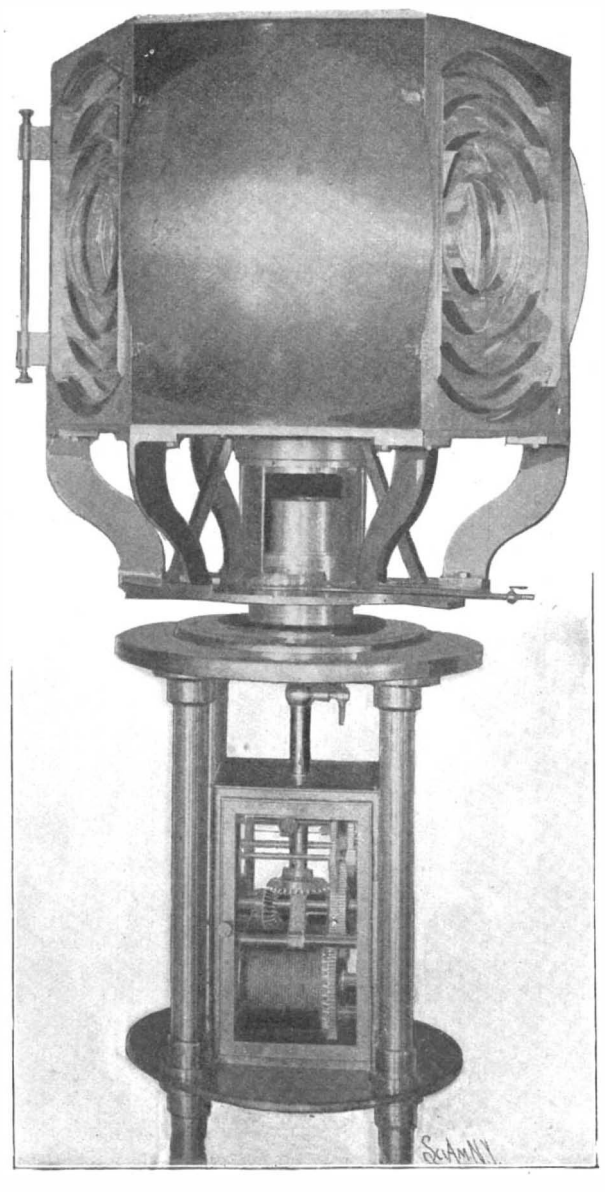

Fig. 5.—FOURTH ORDER FLASHING LENS LAMP FITTED WITH HEAP'S BALL BEARINGS.

The principal advantage is the speed of revolution which can be obtained by this system. Incidental advantages are the increased room in the lantern, the ease and certainty of regulating the speed while the lens is in motion, the facility with which the ball bearings can be removed and replaced, and the addition of the electric alarm to warn the keeper if the lens should slow down or stop from any cause.

A third order lens at Sturgeon Bay Canal Light Station is now revolved on this principle, but I do not consider that it has yet been in use long enough to have got beyond the experimental stage.

The Scientific Extermination of Locusts.

The locust or grasshopper inflicts enormous damage annually. Of late years it has been most destructive in Algeria and Morocco, and in South and East Africa. Its ravages in the United States have been most severe in cities west of the Mississippi, and the destruction in some areas has, at times, been so great that farmers have been compelled to leave their homes and seek a livelihood elsewhere. It is possible that a remedy discovered in South Africa may restrict if it does not wholly destroy the evil. There is ground for encouragement in the great success of the experiment.

In 1895, according to The New York Sun, the locusts in Cape Colony appeared to have been almost destroyed by an epidemic, and investigation carried on by Mr. M. S. Evans seemed to prove conclusively that the disease was the result of feeding upon a fungus growth now known as "locust fungus," and that a few insects affected with the malady might communicate it to millions. In the following year a similar epidemic occurred in Natal, and the idea began to prevail that the malady might be propagated among locusts wherever they became troublesome. After repeated experiments in the Bacteriological Institute at Grahamstown, Cape Colony, a pure culture was obtained from the locust fungus, and the insects that were brought in contact with it at the institute died.

In 1897, experiments on a large scale in the artificial propagation of this disease were carried on in Cape Colony, Natal and Rhodesia, with very satisfactory results. Immense swarms of locusts perished a few days after the infection of a number of individuals in each group. It was also found that the best results were obtained during the periods of rain, when the locusts remain a longer time in one place, and the spread of the infection was thus facilitated. On the contrary, in dry, hot weather, when the flight of the insects was rapid, the sick were left behind and the majority escaped contagion. The Bacteriological Institute now sends out the culture from the locust fungus in tubes which may be sent thousands of miles away.

It is applied in various ways; one is to smear several insects with the culture and let them rejoin their swarm; another is to drop the contents of the tube upon bits of humid earth where the insects are feeding; another is to bottle up the locusts with a little of the food which they prefer covered with the culture, and after they have eaten the food to set them at liberty. It has also been suggested, but presumably it has not been tried, to put the contents of the tube in a basin of warm water and immerse a number of insects in it and then set them free. The new remedy has been tried in the Kilimandjaro district. Ten locusts were treated from each of the five different swarms, and in four days after the infection the five swarms were lying dead in heaps. Locusts have been a great scourge in German East Africa and fresh culture tubes are to be supplied gratuitously to planters, missionaries and merchants, and will undoubtedly prove a great boon.

THE British government has chartered 109 vessels for the transportation of troops.

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PROGRESS OF THE PARIS EXPOSITION OF 1900.

It was a foregone conclusion at the close of the Exposition of 1889 that another great gathering beside the banks of the Seine would be held by the end of the century, and in a few months the Exposition of 1900 will have thrown open its doors, and for the eleventh time France will welcome the world to her exhibition. The Exposition of the year VI. was held on the Champ de Mars under the Directory in 1798; the Exposition of the year IX. (1801) was held in the Court of the Louvre; the Exposition of 1806 on the Esplanade des Invalides; the fourth was held in 1834 on the Place de la Concorde; the Exposition of 1844 on the Champs Elysées; the next Exposition was opened in 1849, also on the Champs Elysees; the Exposition of 1855 was held in the Palais de l'Industrie on the Champs Elysées, which has just been taken away to make room for the Grand Palais of the Exposition of 1900. The Exposition of 1867 was held on the Champ de Mars, as was also that of 1878 and of 1889.

Paris is unfortunately situated for the purpose of giving expositions on a large scale owing to the fact that about the only available spaces which it has are the Champ de Mars, the Esplanade des Invalides, and the park between the Trocadéro and the Seine, and the triangular bit between the Champs Elysées and the Avenue d'Antin. There is one advantage, however, for this valuable territory lies in the center of the city and is accessible from almost any point. For convenience it can be said that the Exposition of 1900 is made up of six sections. First, the Champs Elysées, which is connected with the second section on the Esplanade des Invalides by the Pont Alexandre III. The third and fourth sections lie on both banks of the Seine and make an unbroken line of buildings on both sides connecting with the fifth and sixth sections on the Champ de Mars and at the Trocadéro.

The Exposition of 1889, properly speaking, did not have any main entrance, but this has been remedied in the present instance by building an enormous construction on the Place de la Concorde end of the Quai de la Conference. This triple archway will have a span of 59 feet and is 65 feet high. The sides have penetrations consisting of smaller arches. At both sides will be a large number of gates, arranged in a fan shape, which will permit of 60,000 persons per hour to pass through them. The entrance is built of light masonry and is covered with enameled sheet iron. The summit of the arch is surmounted by a gigantic statue of "Peace." Two large exedra join the great arch at the bottom, adding to its appearance of strength. Two lofty minarets flank the arch. From the illustrations which have been published of this entrance, it is doubtful if the effect will be at all good from an architectural point of view. The architect has thrown to the winds all of the canons of his art, and we should be surprised if the result is successful.

One of our engravings represents the Grand Palais of the Champs Elysées, which is not far from the monumental entrance. It occupies the site of the Palais de l'Industrie, which has been destroyed to give place to it. The architectural design was obtained after a severe competition, and M. Bouvard was selected as the architect. The result is that the building is a most handsome and pleasing one and is in marked contrast to most of the Exposition buildings, whose ephemeral character is no excuse for decorative aberrations. It will cost about $4,000,000. The building is admirably arranged for the display of art collections, and access to the various halls is easily obtained by numerous stairways. The curved ends such as are shown in our engraving produce an excellent effect. The building will, of course, be permanent as it is being constructed of fireproof material and the workmanship is of the very best. Another art palace devoted to retrospective French exhibits faces it. This smaller palace of art will also be permanent. The grounds about the palace of art are being beautified in such a manner that the landscape gardening which is being done will connect naturally with the existing shrubbery and trees, which will give a park-like aspect which will harmonize with the famous promenade the Avenue Champs Elysées immediately to the north.

The splendid Avenue Nicholas II. brings the visitor to the Pont Alexandre III., which connects the second great section of the Exposition with the entrance and the art palaces. This bridge is one of the most beautiful, from an architectural point of view, which has ever been built. The corner stone of the structure was laid October, 1896, by the Czar of Russia. The bridge is 360 feet long and the width is 131 feet; the approaches are monumental. Two pylons will be placed at each end surmounted by statues, and statuary is freely used throughout the bridge, which is constructed of steel with stone approaches. This bridge will be illustrated at some future time. One of our engravings shows the present condition of the Esplanade des Invalides, looking down toward the dome of that building, which is directly over the tomb of Napoleon. These palaces will be largely devoted to exhibits in manufactures and the various industries and include the Palace of National Manufactures, the Palace of Miscellaneous Industries, the Palace of Ceramics and Glass. There are two sections of each building, one on either side of the esplanade, one devoted to French products and manufactures and the other to foreign exhibits in the same class. These buildings will form a continuous group.

A large number of visitors from out of town and outlying sections of the city will enter the grounds at this point from the new Gare des Invalides, the station being underground. On the Seine's north bank west of Alexandre III. bridge will be placed some of the most interesting and beautiful structures of the Exposition. On the south embankment will be constructed the Palaces of the Nations, in the midst of which our national building has a prominent position. A little further along on the southern side of the river is the building devoted to army and navy exhibits. Beyond this is the Palace of Commerce and Navigation. Then comes the Pont d'Iéna, connecting the Trocadero ground with the Champ de Mars. Beyond this are the buildings devoted to forestry, hunting and fisheries. The Gare de Champ de Mars comes up directly to the buildings on the Champ de Mars and affords a third important entrance to the Exposition. The Eiffel Tower on the Champ de Mars has been left to form a salient feature of the entire group of buildings. The view from the foot of it, even at the present time, is most imposing. To the left rises a building devoted to mines and metallurgy, one section of which is shown in our engraving. Next comes the palace devoted to textile fabrics and cloth; then comes the huge palace devoted to mechanics, while directly in front is the Electricity building, whose façade is composed of an enormous Chateau d'Eau, while behind rises the large roof of the building which includes the agricultural exhibit, food products and a salle des fêtes. On the other side of the fountain there is another section of the Mechanical building, then comes the Palace of Chemical Industries, then the Palace of Civil Engineering and the palace devoted to education, letters, arts and sciences.

It is impossible at the present time to get an adequate idea of what the effect will be when entirely finished, as to color, etc., but we may safely trust the taste of the French to produce an ensemble which, while it may be very pure in details, will not be barbaric. In the grounds surrounding the Trocadéro will be the buildings forming the colonial exhibits. Along the north bank of the Seine will be buildings devoted to horticulture, arboriculture, the city of Paris, and a unique group of buildings representing Paris of the middle ages. This is probably the most important amusement section of the Exposition, and will be devoted to theaters, concerts, restaurants, cafés, etc., as well as to show the appearance of Paris in the fifteenth and eighteenth centuries. The studies for this most attractive and monumental group of buildings were made by M. Robida, well known as a draughtsman of the architecture and life of the middle ages. There are forty-two distinct sections in the group of buildings, each one representing a different phase of the life and activities of old Paris.

There is another section of the Exposition at Vincennes for agricultural machines, carriages, bicycles, automobiles, etc., and direct connection can be had from the Exposition proper by means of steamboats and trolley cars. The space to be occupied by the Exposition proper is 360 acres, and of this amount the French government has given about 60 per cent to other nations and reserved about 40 per cent for France. The Exposition will open on April 15, 1900, and there is every indication at present that it will be ready at that time.

The Future of South Africa.—I.

BY EDGAR MELS, FORMERLY EDITOR OF THE JOHANNESBURG DAILY NEWS.

Much has been written of the past of South Africa—of its wars, its peoples, its peculiarities and idiosyncrasies. Little has been said of its future and its really marvelous resources. Chroniclers and historians have delved into its past for interesting material, and have found it. But to the practical American mind, the commercial and financial future of the southern end of the African continent will appeal with more force than the tale of battles with Dinizulu, or the discovery of diamonds on the Vaal River in 1869.

Civilization and commerce go hand in hand, and if the present war should lead to a more thorough civilization of South Africa and a greater opportunity for commerce, England would be entitled to the thanks of America, for America will profit more through England's victory than Britain herself. At first glance, this statement may seem preposterous, but a little study into conditions will convince any fair-minded reader that America will be the commercial paramount power in South Africa within another five years after peace shall have been declared.

Up to the time of the declaration of war, ninty per cent of the mining machinery at the gold and diamond mines was of American manufacture. An even greater percentage of agricultural implements came from America. Vehicles of all kinds were American, and not so long ago, the mule-propelled cars along Dutoitspan road, Kimberley, bore the inscription "Broadway, from Battery to Central Park"—relics of the days of horse cars on Broadway.

American liquors, such as beers and whisky; American clothing; American wagons and American hardware have all been favorites in South Africa. Then, too, Americans themselves have been well treated. An American is the practical head of the De Beers diamond mines. An American was formerly the State Mining Engineer in the Transvaal, and fully one-half of the mine managers at the Witwatersrand gold mines are Americans.

This speaks well for America and augurs still greater things for our country in the future. We are friendly with all of the contending parties. England sees in us a moral ally. The Transvaal and the Free State look to us for moral aid in settling their difficulties with Great Britain. No matter which side wins, we will be the gainer. If England is successful, she will extend all possible favors to us. If the Boers should win, America, being a republic, would still be in favor, especially as the Boers are fond of America in the abstract, even though they may not fancy the individual American—for some of America's representatives in South Africa have not been all that could be desired.

So America will be the gainer unless, and that phase is one likely to come up at any moment, there is a rising of the natives. If that should come to pass, then South Africa will be a land of terror and desolation. Whether the eleven hundred and fifty-one tribes will remain quiet or not, it is impossible to predict. At this writing, they are still at peace with the white man, but any hour may bring a change. So long as either the Briton or the Boer shows decided supremacy in the field, so long will the native remain peaceable. But let the whites rend each other in death struggle, let them be so evenly matched in the game of war that both sides are decimated, and then the world will see a rising of natives compared with which the Indian mutiny will be insignificant.

The native fears the Boer, for the Boer has taught him many a bloody lesson. He respects the Briton also, and will not attack either while Briton or Boer is in condition to strike back. But let the white forces be grappled in death struggle, with thousands of homes and many towns unprotected, and then the native will arise in his might. Then blood will run as it did when the forbears of the Boers were slaughtered on St. Bartholomew's night. The native will avenge his wrongs, real wrongs too, in the blood of the white. Unkindness will be repaid with murder; kicks and lashings with rapine; injustice with death and desolation. It will be heaven's vengeance for years of outrageous wrongs, wrongs to which the grievances of the Uitlanders or the complaints of the Boers are mere bagatelles.

It would take more than one hundred thousand whites to suppress a universal uprising of the natives. The Matabeles, Mashonas, Basutos, Zulus, Bechuanas, Swazies, Amatongas, Khama's Men, and the other eleven hundred and odd tribes, could put two million men into the field, every one brave to the point of folly, every one fired with desperate hatred toward the white, every one fighting to avenge a personal wrong. Ten thousand killed in battle could not stop the avalanche of blacks; they would crush the white man, and white supremacy in South Africa would be again a thing of history if once the natives rise. It would take the better part of a century to restore the old order of things. That is why both the Briton and the Boer have so far refrained from inciting the natives to take arms.

Leaving aside the unpleasant possibility of a native uprising, South Africa will soon be the field for great commercial and financial advantages. Peace must come sooner or later, and then America will reap the reward of British aggression and Boer stubbornness. South Africa will need much mining machinery, corrugated iron houses, clothing, underwear, nails, hats—in fact, everything that a human being needs will be wanted.

South Africa has no manufactories; everything must be imported, whether it be whisky or clothing. Even agriculture has been neglected in the mad rush for wealth and, incidentally, ruin. Legitimate business has been abandoned for speculation, and commercial honesty has been on the verge of oblivion. When the war shall have cleared the atmosphere, business, as it is understood in this country, will once more take the place of scheming, and so good may yet come from bad.

But one thing Americans must heed, or they will regret their lack of sense; they must avoid gold and diamond and all other mines as they would the evil one. South Africa is too thoroughly in the clutch of the unscrupulous speculator and promoter to warrant the investment of American capital in anything save legitimate business. If speculative Americans must invest in mines, let them seek new ones (there are plenty to be had for the developing), and then keep absolute control in their own hands. For the South African promoter is first cousin to Bret Harte's China-

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man—childlike and bland, but with sundry and various financial tricks that are delightfully ingenious, even though they are apt to impoverish those who are foolish enough to be ensnared.

Some two thousand million dollars have been invested in South African mines. English, French, and Germans have furnished the money. Alfred Beit, J. B. Robinson, the Barnato Brothers, Wertheim, S. Neuman & Company, Cecil Rhodes, and half a dozen more, are worth close to a thousand million dollars between them. Every bit of this stupendous sum was made through the flotation of mines. All of the mines, with two exceptions, are greatly overcapitalized. About forty of them have paid dividends ranging from fifteen per cent to six hundred and seventy-five per cent; but as only those within the sacred circle know whether these huge dividends were honestly earned, it is advisable that American investors should leave all speculative investments to the less careful Briton, Frenchman, and German.

(To be continued.)

The Vienna Meteorite Collection.

BY OLIVER C. FARRINGTON.

At 6 o'clock on the evening of May 26, 1751, a number of people in Hraschina, near Agram, Austria, saw a fire ball suddenly appear in the sky. It advanced rapidly from west to east, drawing a trail of smoke behind it, and after a mighty detonation there fell from it to the earth two masses of iron at places about half a mile apart. The smaller of these, weighing about 20 pounds, was broken in pieces by curiosity hunters, some of it forged for iron and all lost. The larger, weighing about 90 pounds, was sent to the imperial treasury of Austria and kept there until 1778, when it was assigned to the imperial mineral collection at Vienna then in process of formation. This was the beginning of the collection of meteorites of the Vienna Natural History Museum, a collection which is to-day not only the greatest of its kind in the world, but is considered the most valuable, as it is the most celebrated, of all the treasures of that truly imperial museum.

In looking at this collection, made up of specimens of falls which have taken place at more than five hundred localities in all parts of the world, one finds it hard to realize that it has all been built up practically within the present century, or to appreciate the still more striking fact that only within the same period would a collection of bodies claimed to have fallen from the sky have been tolerated in a museum of scientific repute. Up to the beginning of the present century scientific men heard with scorn and incredulity reports of the fall of stones from the sky; the French Academy, after a sitting on the stone which fell at Lucé in 1768, decided it to be a terrestrial stone struck by lightning, and threw away the specimens sent them. Hence, meteorites at that time were to be found only in the hands of private individuals, who preserved them as curiosities, regarding which extraordinary stories were told. But the powerful philosophic mind of Chladni, reasoning in regard to the masses brought by Pallas from Siberia, reached the conclusion that they must be of extraterrestrial origin, and the weight of his arguments, together with evidences gathered by many scientific individuals or societies in the careful investigation of a number of reported falls, led, at the beginning of the century, to a revulsion of feeling. Scientific men became as eager to collect and study the "sky stones" as they had been scornful of them before. The stones were sought for all over the world, and the knowledge gained from their study soon formed a science of its own. Of the fruits of a century of such efforts the Vienna collection is, perhaps, to-day the best exponent.

It was on a specimen of the Vienna collection too that Alois v. Widmannstätten, Director of the Vienna Industrial Museum, and an experienced student of the structure of iron, in 1803 made the remarkable discovery that by heating the iron regular figures were developed. These were soon found to characterize meteoric irons in general, and they have ever since been called by his name. In other ways the growth of the Vienna collection has paralleled to a large degree the growth of the science of meteorites. In 1805, but 8 localities were represented in the collection; in 1835, 56; in 1863, 245; and at the present time there are 502, a number which falls but little short of the whole number known. The whole weight of the meteoric matter now in the collection is 3,510 kilogrammes. As at present installed the collection occupies one hall of the Natural History Museum. The specimens are placed for the most part in low desk cases, but the larger ones have individual mounts with or without cases. The collection is divided into a terminological and a systematic series. First in the former comes a collection illustrating the history of meteorites. Ancient coins from Macedonia, Cyprus, Sardis, Sidon and other countries are shown which bear images of meteorites and legends indicating that such bodies were held sacred at different times in those countries. A specimen of the Kesen, Japan, meteorite, worshiped until within a few years by the Japanese, illustrates the same practice in modern times.

The scientific history of meteorites is illustrated by a fragment of the Lucé stone, so scornfully rejected by the French Academy, by the section of the Hraschina iron etched by Widmannstätten, by a piece of the Pallas meteorite which Chladni proved to be of extra-terrestrial origin, and by stones of the fall of L'Aigle, which was the first meteoric fall to be generally accepted as of extra-terrestrial origin. In connection with these are shown materials which have fallen from the atmosphere at different times but which are doubtless of terrestrial origin. Some of these are red dust from a red snow which fell in Switzerland in 1818, crystals of marcasite which formed the kernel of hail stones that fell in Russia in 1824, fragments of calcite the size of a pea that fell on the deck of a ship near San Domingo in 1822, and last of all a series of so-called pseudo-meteorites, i. e., bodies which have for some reason been claimed to be meteorites but which do not satisfy the tests in all points. The pitted surfaces are similar to those found on the surfaces of large gunpowder grains picked up after the firing of heavy cannon. The shell-like forms of some meteorites are shown to be due to their having scaled off from some larger spherical mass. The hollow or ring-like shape of others is shown to have been produced by the melting out of a nodule of the easily fused troilite (iron sulphide). The constituents of meteorites are illustrated by fragments of each, naturally or artificially separated. There are large and perfect crystals of troilite from several meteorites (one from the stone of Juvinas being the size of a hazel nut), of olivine from the Pallas meteorite, of altered diamond (cliftonite) from the Magura iron, of crystallized diamond from the stone of Urej, and many specimens of the well-known meteoric minerals, schreibersite, taenite, graphite, and cohenite. In another case are shown etched sections of many iron meteorites, illustrating the great variety of structures and figures which they exhibit.

In the systematic collection the specimens are grouped according to a classification proposed by Tschermak and somewhat modified by Brezina. Its leading divisions are (*a*) stone meteorites, divided into polyhedrites, chondrites, and siderolites, and (*b*) iron meteorites, divided into litho-siderites, hexahedrites, and ataxites. Here most of the specimens are placed included under their group character. The qualities and features of any of these groups would furnish study for a lifetime. Many are fragments, such as the custom of meteorite collecting has made to constitute a specimen. Of others, such as De Cewsville, Calderilla, and Lancé, the collection contains all, or practically all, known to exist. It is remarkable how many of the best known American meteorites of the past century are to be found here. The meteorites of Mount Joy, Estherville, Cabin Creek, Chulafinnee, Babb's Mill, and many others belong to this collection either entire or in larger quantity than any other. This is less likely to be true of American meteorites in the future, for several collections in our own country are now sufficiently well established to be able, we hope, to keep American meteorites at home.

At either end of the main collection are cases containing the largest and most valuable "uniques." Many of these have great interest for their terrestrial as well as for their extra-terrestrial history. Among them is the iron weighing about 9 pounds which fell at Mazapil, Mexico, in November, 1885, during a star shower. By those who believe in the cometary origin of the meteorites, this iron is supposed to be a part of Biela's comet, since the comet was due at the time of the fall. Another interesting specimen is the iron weighing 107½ pounds which fell at Cabin Creek, Arkansas, in 1886. Besides being interesting as one of the few irons ever seen to fall, it shows upon its surface beautiful lines of flow, caused by the melting of the metal as it passed through the atmosphere. The meteorite has a typical conical shape. Another is the iron of Hraschina, already mentioned, and another a large section of one seen to fall at Braunau, Bohemia, in 1847. The iron of Babb's Mill, Tennessee, in size and shape resembling a roll of Vienna bread and about as hard, is here shown too. Two other meteoric irons shown—those of Kokstadt, South Africa, and Hex River Mountain, South Africa—have a remarkable shape, resembling an underjaw of some large mammal.

Here too is the principal mass of the Elbogen iron, a mass preserved for more than four centuries in the town hall of Elbogen and known as the "Enchanted Burgrave." The tradition held among the people regarding it was that if it were thrown into the fountain at the castle, it would come back again to its former location. The tradition proved true, for in 1742 the French, to test the saying, scornfully threw it into the fountain, but in 1776 the citizens brought it back to its former place. Another specimen here shown, which must have fallen at an early period, is a mass of iron weighing 42 kilogrammes found at Catorze in the State of San Luis Potosi, Mexico. In one side of it is seen a copper chisel of ancient manufacture evidently driven in by some of the aborigines in an attempt to dissever a piece of the iron. Besides these smaller specimens, three iron meteorites of greater weight occupy separate pedestals in the hall. One of these is a mass weighing about a ton, found in 1884 in Youndegin, Western Australia. Its surface is penetrated with funnel-shaped holes made undoubtedly by the erosive action of the air as it fell, while the coarse crystalline structure of the iron is marked by external lamellæ. The two other large irons on pedestals are one weighing 198 kilogrammes from the State of Coahuila, Mexico, and the other weighing 177 kilogrammes from Cañon Diablo, Arizona.

Among the large stone meteorites may be noted many of great size from the fall of Knyahinya, Hungary, which took place June 9, 1866. A large painting decorating the wall of the hall represents the surroundings and appearance of the fall. Over a thousand stones fell in this shower. One of these stones weighs 650 pounds and it was until recently the heaviest meteoric stone mass known to have reached the earth. The Long Island, Kansas, stone, now in the collection of the Field Columbian Museum of Chicago, is, however, larger, its weight being fully a thousand pounds. Other important stones shown nearly entire in the Vienna collection are the Lancé, a carbonaceous meteorite, the Tabor, which fell in 1753, and was one of the first meteoric stones to be studied by Howard and Chladni, the Tieschitz and the Wessely.—Field Columbian Museum, Chicago.

Automobile News.

The postmaster of Brooklyn, N. Y., is planning to use automobiles for the delivery of mail in that borough. If the experiments are successful, the use of the trolley mail cars will be abandoned, and probably smaller automobiles will be used for collecting the mail. At present curious little two-wheeled carts drawn by horses are used.

There was recently an extraordinary parade of traction engines at Aldershot, fifteen engines and forty trucks. They were inspected previous to their departure to South Africa. A stretch of sandy road was selected for the test, and the country gave an excellent opportunity for observing the practical points of the engines. They will be dispatched to South Africa at once.

Dr. R. J. Gatling has just invented an automobile plow. It is built on the principle of the ordinary automobile with disk plows so arranged as to do the work of the implements now in use. The idea is to operate a machine by a single man. It is claimed that it will do the work of eight men and twelve horses. Either gasoline or kerosene may be used. It can also be used in driving a thrasher, shelling corn, or for other purposes. Another machine is for the cotton fields, and is designed for "thinning out" cotton plants in their early growth.

There is every indication that in a short time drivers of automobiles will be allowed to run their vehicles through Central Park if they are competent to manage them with safety to other users of the park. President Clausen made two trips through the park in an electric automobile, one on Sunday afternoon and one Sunday evening. The trips were an entire success in every way, and demonstrated that if the vehicles are run with caution, there is no danger of frightening horses. The trip was an interesting one. First came the sergeant of the Park police squad, followed by the automobile carrying the president of the board and Mr. R. A. C. Smith, the owner of the automobile. Mounted policemen rode at either side and three more officers on horseback brought up the rear. The policemen were ordered by Mr. Clausen to accompany the carriage, in order to be on hand should any runaway occur. The vehicle behaved admirably and Mr. Clausen promptly issued a permit to Mr. Smith to operate his automobile in the park whenever he pleased. It may seem hardly fair that only one man should have this permission, but owners of horseless vehicles will not be disposed to grumble very much, as this is a great step toward securing the end desired. No one ought to desire proper regulations for the use of parks more than automobile drivers. Incompetent persons should never be allowed to drive vehicles of any kind through the park when they are liable to injure many persons.

IN the United States the first-class passenger fares last year averaged 2·14 cents per mile, although on some large railways the average was several mills less then 2 cents per mile. In England the first-class fare is 4 cents per mile; the third-class fare for vastly inferior service is 2 cents per mile; in Prussia the fare is 2·99 cents per mile; in Austria 3·05 cents per mile, and in France 3 36 cents per mile. George H. Daniels' interesting and important address, from which we extract the above, is concluded in the current number of the SUPPLEMENT.

NEAR a station in Utah a car loaded with powder was blown up while in transit. The force of the explosion was so great that, according to The Railway Review, it tore up 90 feet of track. It shook the whole freight train and broke glass in the engine cab windows and caboose. The powder car and two adjoining cars were burned up.

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AMERICAN ARMOR PLATE FOR A RUSSIAN BATTLESHIP.

By the courtesy of the Carnegie Company we are enabled to present the accompanying illustrations of certain armor plates which were recently tested by the naval authorities at the Indian Head proving grounds. The plates were manufactured under two different processes and were subjected to two different kinds of tests. The two plates which show the long, horizontal scoring form part of a large number which were manufactured for the flat portions of the protective deck of the new Russian battleship "Retvizan," which is now under construction for the Russian government at the Cramp Shipyard, Philadelphia. The third plate showing the mark of five separate impacts represents the side plating for protecting the rapid-fire battery of the same vessel.

If our readers will turn to the SCIENTIFIC AMERICAN for November 5, 1898, they will find illustrations and a description of this vessel, from which it will be learned that she is protected with a 9-inch belt at the water line associated with a protective deck, which will be 4 inches thick on the slopes and 2 inches on the flat portion. Above the 9-inch belt and between the protective and the gun decks will be another belt of 6-inch armor extending between the main barbettes, and above this, protecting the broadside battery, will be a wall of 5-inch plating. The plates shown in Figs. 2 and 3 represent a lot manufactured for the 2-inch protective deck, while the test plate shown in Fig. 1 was taken at random from the 5-inch plates for the protection of the secondary battery.

The test carried out upon the 2-inch plating was arranged to represent the conditions under which a shell would strike the flat portions of a protective deck in actual warfare. Should a shell pass through the side of a ship at the ordinary fighting ranges it would strike at a sharp angle with the deck, and this condition was represented in the test by firing a number of 6-inch armor-piercing projectiles at angles of about 15 degrees to the plates. The plate shown in Fig. 2 was 2 inches thick. It will be seen that two of the shots made long indentations and bulged the plate considerably, and only one got through. The plate shown in Fig. 3 was made up of two 1-inch plates, and the projectiles were 6-inch armor-piercing Carpenter projectiles, the striking velocity in the case of the lower impact being 1,160 feet per second. The first shot deeply scored the outer plate, but the plate was not broken. In the case of the second shot, the outer plate was cut through for a length of 26 inches, the opening being 1⅛ inches wide at the middle of the fracture, but the second or backing plate was not cut or even scarred. These plates are of ordinary soft nickel steel treated by the Carnegie system and the results, considering the energy of the projectile and the angle of impact, are very satisfactory.

Fig. 1 is one of the most remarkable photographs of armor-plate test ever taken. The plate was manufactured under the Krupp patents by a process which is a development of the American Harveyized process, and has shown results which are a great advance in respect of hardness of face, depth of hardening and the general toughness of the body of the plate. The first shot fired from a 5-inch rapid-fire gun struck in the center of the plate with a velocity of 2,060 feet a second and broke up, the penetration being only 2 inches, and the point of the shell remained embedded. The velocity of the second shot was 2,086 feet per second, of the third 2,057 feet per second, and of the fourth 2,089 feet per second, and the last shot struck with a velocity of 2,060 feet per second. In every case the projectile failed to penetrate more than about 2 inches, and left its point welded into the face of the plate. Had the ordinary Harveyized armor been used the penetration would have been more than twice as much, or about 4·4 inches. It will be noticed that not only did the plate resist penetration and break up the projectiles, but it had sufficient toughness to hold together without cracking or fracture. The result is positively astonishing to anyone who has not kept close touch of the progress which is being made in armor plate manufacture under the Krupp process. In spite of the enormous increase of late years in the power of naval guns, the victory in the struggle between the gun and the plate rests to-day with the latter. We commend this photograph to the thoughtful and intelligent attention of the two or three Congressmen who have been endeavoring only too successfully to prevent the country from using Krupp armor upon its ships. Had this plate been of the kind which they are anxious to force upon the navy, it would probably, under such a fierce attack as the above, have been cracked from end to end. We would also draw their attention to the fact that this plate was made in America to be placed upon the sides of a ship which is being built in this country for the Russian navy, and we would ask whether it is desirable that we should place the best armor upon foreign ships and clothe our own with armor of a distinctly inferior grade.

Fig. 1.—TEST OF 5-INCH KRUPP PLATE FOR RUSSIAN BATTLESHIP "RETVIZAN."

Impact No. 5 by 5-inch, 50-pound projectile; striking velocity, 2,082 feet per second; striking energy, 1,502 tons. Projectile smashed, point welded to plate, penetration 2 inches. Penetration on similar Harveyized plate would have been 4·4 inches.

CARNEGIE
2"- NICKEL STEEL PLATE 30469.
REPRESENTING GROUP No. 3. P.D.P. ARMOR.
FOR RUSSIAN VARIAK AND RETVIZAN.
GUN USED. 6 R.F. IMPACT. No 3.
SCI.AM.N.Y.

Fig. 2.—TEST OF 2-INCH NICKEL-STEEL PLATE.

Attacked by 6-inch projectiles fired at an angle of 15 degrees with the plate. Impact No. 3, by 6-inch projectile; striking velocity, 1,639 feet per second.

CARNEGIE
2-30" NICKEL STEEL PLATES 10329
REPRESENTING GROUP No. 2. P. D. P. ARMOR
FOR RUSSIAN CRUISER HULL 301.
GUN USED. 6 R.F. IMPACT No. 2
SCI.AM.N.Y.

Fig. 3.—TEST OF TWO 1-INCH PLATES.

The lower impact made by 6-inch projectile; striking velocity, 1,160 feet per second; cut through outer plate but failed to injure second plate.

Effect of Heat on Scorpions.

An interesting question has from time to time been discussed by naturalists and physiologists, as to whether the scorpion commits suicide by stinging himself with his own venomous dart. Experiments have often been made, which consist in surrounding the scorpion with a circle of fire, usually formed by small pieces of burning coals. One may then see the animal agitate his tail in the air, waving his dart to and fro over his head in a desperate movement, and finally fall dead, appearing to have decided that he could not escape from the flames and to inoculate himself with his own venom. This idea is now, however, found to be erroneous, as it has been proved that the scorpion is not affected by his own venomous fluid, and the hypothesis of his suicide cannot be maintained. It appears from later observations made upon the death of the scorpion under the conditions in question, that a more simple explanation is to be found. The scorpion is, in fact, very sensitive to heat, and is easily killed by a temperature not exceeding 50° C. If one concentrates the solar rays upon its back by means of a lens one may observe that he tries by means of his tail to remove the cause of discomfort. It is this movement of defense which has hitherto been mistaken for one of suicide, and in reality the scorpion has been killed by the heat to which he has been exposed under such circumstances.

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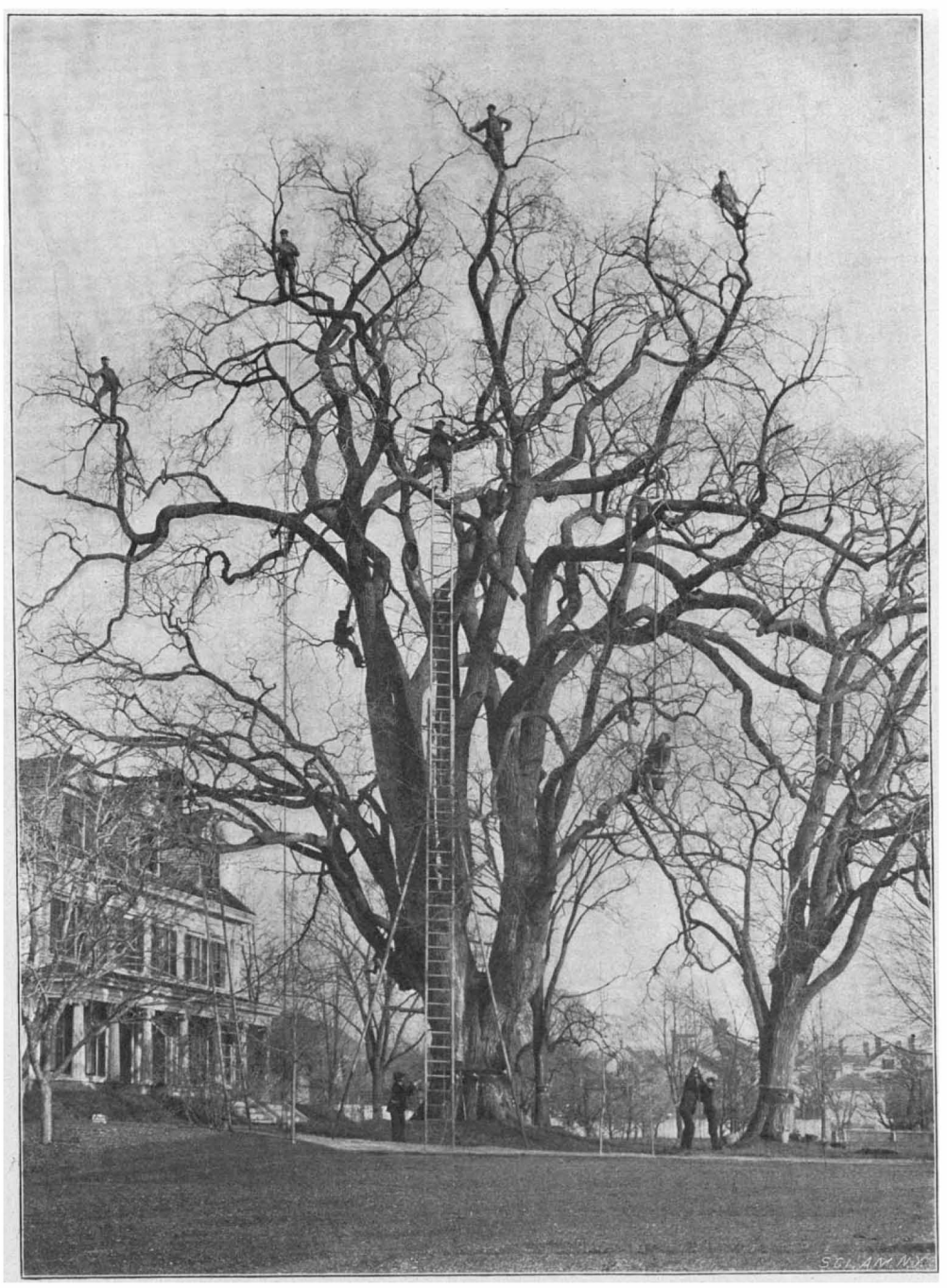
THE GYPSY MOTH.

The attempt on the part of the State of Massachusetts to eradicate the gypsy moth has been generally considered as one of the most important attempts of modern economic entomology. The conditions involve the extermination of a highly prolific species, well established over an area of more than 200 square miles. Mr. E. H. Forbush, of Malden, Mass., Field Director of the Massachusetts Board of Agriculture, presented a review of the gypsy moth work and the results achieved, before the Association of Economic Entomologists at the Columbus meeting of the American Association for the Advancement of Science. The gypsy moth was introduced into America about 1869, but the insect is still confined to a limited area in Eastern Massachusetts, mainly comprising the towns lying north of Boston. The introduction of the gypsy moth was made by Professor L. Trouvelot, the French savant, who was interested in the matter of raising silk from native silk worms. The manner of their subsequent escape is not clearly known, but the result was most unfortunate. Twelve years from the time of its introduction, the moth became a serious nuisance in the neighborhood where it had escaped. It was vigorously fought by the citizens, but their efforts were useless, and in 1889 occurred the famous moth outbreak at Medford, Mass.

The armies of worms that suddenly appeared in June and July seemed about to destroy everything green. They gathered in masses sufficient to blacken houses and fences in certain districts and devastated all sorts of foliage over extensive tracts, killing many trees, and the dropping of the caterpillars on people and sidewalks was most disagreeable. The streets were filthy and in summer nights a sickening odor arose from the mass of caterpillars and pupæ. The destruction of the trees was greatest in those localities where the moth had been the longest. Frequently the trees sustained attacks for two or three years. The caterpillars destroyed not only the foliage and trees, but also fruit and vegetables. When the supply of leaves from the trees fell short, they attacked the gardens; many vegetables were ruined, flower gardens were destroyed and even greenhouses were invaded. Action was taken by the town of Malden in addition to the efforts of the citizens during the attack of 1889. It was soon seen that the nuisance was too widespread to be coped with by the local authorities, and the next year the legislature appropriated $50,000 for the extermination of the pest. A year later the work was placed in the hands of the State Board of Agriculture and they were directed to secure the extermination of the gypsy moth in the Commonwealth. Dr. C. H. Fernald served as entomologist to the committee and Mr. E. H. Forbush as Field Director. At the close of the year 1899, the State of Massachusetts has expended in the annual appropriations for the gypsy moth work the sum of $1,555,000.

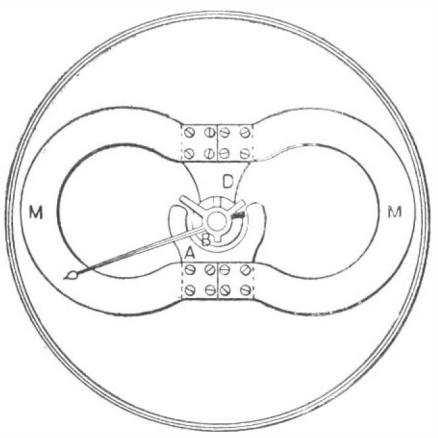
The magnitude of the task can hardly be described. The first six weeks' work of 1891, from careful estimates, showed that the number of different classes of egg clusters destroyed was 757,760, and the eggs probably numbered from 3,000,000 to 5,000,000. Burlap bands were placed around the trees, and in 1899, 53 tons of burlap were purchased for the purpose of banding 2,500,000 trees. The number of caterpillars destroyed by hand beneath these bands amounted in 1895 to 2,164,458. In one small grove in Dorchester, where the trees were defoliated before the caterpillars were discovered, eighteen bushels were killed in a short time. In 1898 the number of tree inspected was over 12,000,000, and millions of eggs have been destroyed by cutting and burning infested trees and underbrush. Caterpillars have been killed en masse by spraying and burning and where such wholesale methods have been employed, no attempts have been made to even estimate the total of the various forms of the moth destroyed. In 1899 at height of the larval season 570 men were employed. The spraying with lead arsenate in the rainless months of May and June was most effective, nearly, if not quite, all of the caterpillars in the sprayed trees being destroyed. It is difficult, however, to find the gypsy moth in the infected region, except in a few localities where the work was not carried on owing to a delay in making the appropriation. The gypsy moth is not exterminated, and during the past summer it appeared in two new places, Newton and Georgetown. The indications are, however, that the gypsy moth will be a rare insect in Massachusetts in the year 1900. We publish a most interesting paper by Mr. Forbush upon the gypsy moth in the current number of the SUPPLEMENT.



KILLING EGGS OF THE GYPSY MOTH ON A LARGE ELM TREE AT MALDEN, MASS.

LONG-SCALE MEASURING INSTRUMENTS.

Mr. B. Davies has designed and constructed several instruments of the D'Arsonval type with a long and uniformly divided scale. They include, says The Philo.



LONG-SCALE MEASURING INSTRUMENTS.

Magazine, a voltmeter, an amperemeter, and a ballistic galvanometer. The latest type of magnetic circuit employed is shown in the diagram. *M M* are the magnets, *A* and *B D* the polepieces. On the soft-iron cylinder, *B*, is mounted the brass frame carrying the entire moving system. It is evident that any quantity of steel may be used. In the voltmeter the moving coil contains some 100 or 200 turns of the finest wire, while the amperemeter coil has some 20 turns of a moderately thick wire.

New Rifles for the Navy.

One thousand Krag-Jorgensen rifles have been supplied to the battleships "Kentucky" and "Kearsarge." Both branches of the service will soon have small arms of the same caliber, thus greatly simplifying the problem of interchangeable supplies of ammunition when the army and navy are required to carry on joint operations. The Lee rifle will gradually be discarded and replaced by the other small caliber rifle. The army ordnance department will manufacture the Krag-Jorgensen rifle for the navy, but the ammunition will be manufactured by the ordnance department.

Annual Meeting of the Society of Naval Architects and Marine Engineers.

The seventh general meeting of the Society of Naval Architects and Marine Engineers took place at the rooms of the American Society of Mechanical Engineers, No. 12 West Thirty-first Street, New York city, on Thursday and Friday, November 16 and 17. Among the papers that were read were several of very special interest, which will be published in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT. Owing to the absence in England of the president, Clement A. Griscom, the annual address was read by Naval Constructor Bowles, the secretary of the society. The address mentioned with regret the death of the senior founder of the society, "that venerable dean of shipbuilding in this country, William H. Webb." Attention was drawn also to the fact that the policy of expansion had benefited the shipbuilders, inasmuch as the large number of vessels purchased for the use of the army and navy, coupled with the increasing use of steam vessels in the coasting trade, had produced the greatest activity ever seen in our coast shipyards, both on the Atlantic and Pacific. Rear-Admiral Sampson was chosen to fill the place of the late William H. Webb as first vice-president of the society.

Recording Meteor-Paths by Photography.

A long communication to the Photographische Mittheilungen, by Herr J. Rheden, shows how any careful amateur who has leisure time and good apparatus for ordinary work may make useful contributions to an important branch of photographic record; a branch of record which should ultimately lead to a considerable extension of our astronomical knowledge. It is pointed out that personal observations as to meteors are subject to so many sources of error as generally to be almost valueless, whereas photographic records made with such apparatus as is possessed by many amateurs may embody in themselves such data as shall make them of the utmost scientific importance. A finely constructed stand with driving clock is quite unnecessary, as star trails are quite as good datum marks as the point-images obtained when the camera is driven. In fine weather and with highly sensitive plates (25° to 26° Warnerke) an objective working at f/4 will give trails of stars at the equator down to the 7th magnitude. Although each magnitude gives 2·5 the amount of light of that magnitude standing below it in the series, it must not be assumed that the photographic relation will be strictly the same in all cases; still, an objective 2·5 times less intense may be considered to register one magnitude less. Further, it may be considered that a meteor of the first magnitude must travel at a speed of 244 times (or 2·5 to the sixth power) to produce a trail corresponding in intensity to a star of the seventh magnitude. Such considerations as the above, without those numerous details which concern the actual operator, will be quite enough to show how the starry heavens may not only form a datum chart as to position, but also a photometer for determining intensity, and obviously it is at the times of the periodic meteor showers that records are chiefly to be made.

A New Artificial Paving Stone.

A new artificial paving stone is made in Germany. It is composed of coal tar, sulphur and chlorate of lime. The tar is mixed with the sulphur and warmed thoroughly and the lime is added to the semi-liquid mass. After cooling this product is broken fine and is added with ground glass, or blast-furnace slag. The blocks are then subjected to a pressure of 3,000 pounds to the square inch.

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The Year's Progress in Agriculture.

The annual report of the Secretary of Agriculture, which will soon be ready for transmission to the President, will be looked for with interest. Under the present administration the highly important work of the department has been broadened, and there are many new fields which have never before been touched upon by the government departments or bureaus. We have already referred to the hybridization of the orange, which may be regarded as one of the most interesting and important of the experiments which have been carried on during the past year. The introduction of new seeds and plants to this country has been a strong feature of the year's work. Various crops, such as ginseng, chicory, and Bermuda lilies, which were formerly imported in large quantities, are now produced in the United States, and it is probable that in time the home demand will be covered.

Agents of the Department are engaged all over the world in gathering seeds and making examinations of the various plants and trees. For example, species of grass and forest plants have been found in Algeria which are proving of the greatest possible value to the southwestern part of the United States, where the soil and climatic conditions are similar to the arid conditions which obtain in Algeria. A new rice which will not break in the milling process has also been found, and will save large sums to the rice growers of the South. We have already described the fertilization of Smyrna figs, which operation is now being carried on in California in the same manner that is in use in Asia Minor. The report deals to a considerable extent with forestry, and the work of the new Forester of the Department shows that lumbermen can cut lumber as is their custom, but they can at the same time at a small expense leave the forests in such a condition as to be valuable for future timber instead of the present wasteful system, which bids fair to work serious injury to certain sections of our country.

We have also noted the interesting tobacco plant experiments which have been carried on by the Department. Irrigation investigations are treated in the report, and the problem is certainly a most important one, as it is said the recent rise in the price of beef was due, not only to an increased demand, but also to the diminished capacity of the Western grazing land, owing to an overstocking and killing out of the native grasses. The broadening of foreign markets is also dealt with. Cold storage shipments of butter are being made regularly, and other dairy products are fast becoming well known and liked in the markets of the world. A note of warning is sounded about our new possessions. The Secretary considers that an inspection law should be formulated and enforced, as when the Americans begin to settle in the islands they will undoubtedly import many new plants and seeds from all over the world. They will, perhaps, unwittingly introduce diseases and insect pests which may ruin the crops. This has been the history of the possessions of other countries. The attitude of the Department, as concerns our new island territory, is one of cordial cooperation.

Successful Trials of the Holland Submarine Boat.

The Naval Board appointed to inspect and report on the performance of the "Holland" submarine boat has reported that in the recent tests, held on November 6, in New York Harbor, she fulfilled all the requirements laid down by the Department. These requirements were that she should have three torpedoes in place in the boat, she should have all arrangements for charging torpedoes without delay, and that she should be prepared to fire a torpedo at full speed both when submerged and at the surface. Lastly, the "Holland" was to make a run for two miles under water, starting from one buoy, running submerged for a mile to a second buoy, rising to discharge a torpedo at a mark near the second buoy, and then after diving again return submerged to the starting point.

In his report Chief Engineer John Lowe, U. S. N., who was specially ordered to observe and report the preliminary trials, says:

"I report my belief, after full examination, that the "Holland" is a successful and veritable submarine torpedo boat, capable of making a veritable attack upon the enemy unseen and undetectable, and that, therefore, she is an engine of warfare of terrible potency which the government must necessarily adopt into its service."

He further says that "this government should at once purchase the 'Holland' and not let the secrets of the invention get out of the United States, and that the government ought to create a submarine torpedo boat station for the purpose of practice and drilling of crews, and that we need right off and right now fifty submarine torpedo vessels in Long Island Sound to protect New York, preserve the peace, and to give potency to our diplomacy."

While we cannot agree with Mr. Lowe in his opinion that we need and presumably should build a whole fleet of torpedo boats "right off and right now," we do think that the "Plunger," a larger boat of the "Holland" type now building for the government, should be immediately completed and further trials of the system carried out.

HAMILTON YOUNG CASTNER.

BY MARCUS BENJAMIN, PH.D.

In his address on "The Advances of Chemistry," which Sir Frederick A. Abel delivered before the British Association in 1890, are to be found the following words: "The success which has culminated in the admirable Castner process constitutes one of the most interesting of recent illustrations of the progress made in technical chemistry, consequent upon the happy blending of chemical with mechanical science, through the labors of the chemical engineer."

This tribute of praise to the young American chemical inventor, whose death occurred last week, makes it desirable that a brief notice of his career be given in these columns, and as it was my good fortune to be intimately acquainted with him during his early professional career, I am very glad of the opportunity to briefly tell the story of his short life.

Hamilton Young Castner was the second son of Samuel and Julia A. Castner, and was born in Brooklyn, N. Y., just forty years ago. After the usual common school education, during which he showed a predilection for scientific studies, he entered the Columbia College School of Mines with the class of 1879. He soon manifested such a marked preference for chemistry that he decided to devote himself exclusively to that study, completing the usual four years' course in three. It was in consequence of this that during the last two years of his laboratory work his desk was adjacent to the one where I was engaged and then began our friendship, which continued until his death. For his graduation thesis he made an exhaustive study of the water from the wells then still in use in the city,

HAMILTON YOUNG CASTNER.

and it was largely in consequence of the results obtained by him that the Board of Health, at that time under the direction of Professor Chandler, ordered all of these sources of disease to be abandoned.

Almost immediately after graduating he opened an analytical laboratory on Pine Street, and in consequence of his ability soon gathered around him a valuable following that accepted his advice on all chemical matters without question. Notwithstanding the fact that there were many competitors, he increased his business within a year so that larger quarters were necessary, and he then moved to Pearl Street, where he continued with his elder brother for several years. Meanwhile, however, his active mind sought for occupation in studying improvements on then existing chemical processes. The first important problem that he took up was a method by which carbon could be produced continuously. This he successfully accomplished, but was unable to find a market for the process owing to the depressed financial condition of the country at that time, and also from the fact that the larger firms engaged in that business consolidated and reduced the price below that on which his calculations were based. He then began the study of an improved process for the production of aluminium, and with his usual energy and ability devised a modification of great value on the then long and tedious process in existence, which received very great commendation from the leading chemists of the world. It was considered so valuable that he received favorable overtures to erect a plant in England, and in a short time the well-known works at Oldbury, near Birmingham, were built under his supervision. The electrolytic process soon after came into existence, and in consequence, for a time, the market for his aluminium was taken from him, but his resourceful mind soon saw the value of sodium peroxide, which was one of the products in his aluminium process, and he forthwith created a demand for that article and put it on the market, thus commanding success when failure seemed inevitable. Later he devoted his attention to an electrolytic method for the manufacture of bicarbonate of soda, which was successful and increased his reputation.

It is not possible to follow the development of the different processes of which he was the originator, but besides being connected with the Aluminium Company of Oldbury, he was also associated with the Castner-Kellner Company, the Mathiessen Alkali Company, the Rheinfelsen Company, and more recently with the Niagara Chemical Company, whose works are near Buffalo in this country.

In the exercise of his peculiar ability I know of no one his equal in this country. In considering an improvement for a chemical process he first carefully studied the subject from books, and then laid down a course of investigation which he continued until success crowned his efforts. His reputation will grow as the years pass by, and the science of the world has met with a serious loss in his untimely death.

"DON COYOTE."

BY PROF. CHAS. FREDK. HOLDER.

One of the interesting and typical animals of the far West is the American wild dog, lowland wolf or coyote, Canis latrans, it being known under these and other titles. While a very common animal, it is rarely well figured in the books, and is made to look more foxlike than wolfish. A wolf the coyote is, a lowland form, and every traveler through the West who has wandered from the beaten paths or visited small places knows it well.

The accompanying photograph gives a very correct idea of a young male two-thirds grown. In general appearance it resembles the typical wolf, the fur being a dull yellowish gray with dark, even black, clouded spots; beneath it is sometimes reddish and white.

The coyote is virtually a wild dog and breeds with the domestic dog, and dogs will often refuse to injure the female coyote. The writer observed this once on the mesa near Pasadena when in full chase after a coyote with a pack of grey and stag hounds. One of the dogs reached the game, but instead of seizing it as usual ran along by the side of the coyote, which was a female. Huxley contends that there is no material difference between the skull of a coyote and that of a dog, and a cross between a collie and an Eskimo dog produces a very fair coyote, so far as appearances go.

"Don Coyote" is essentially a night animal, and my observations of the living animal were made chiefly in the saddle in full chase after him in the dull early morning, and I can commend his speed, which is greater than that of the fox. When the sun goes down Don Coyote comes out of his haunts in the foothills and wanders down around or into the settlements. He lies in the spurs of the hills and mountains in Southern California, as in the San Gabriel Valley, in some safe and inaccessible point, and surveys the country, his vision perhaps directed to some henroost or the home of some fat turkey. At such times I have occasionally seen him, his fur an almost perfect protection in its resemblance to the rocks that surrounded him; and that he recognizes this was shown in one instance when I rode within thirty feet of one, pretending to look directly ahead, but watching him out of one corner of my eye. He crouched as I approached, and seemed confident that I did not see him imperceptibly moving, ever keeping his head pointed toward me; and few would have recognized in the gray rock a coyote.

On the outskirts of Pasadena, a city of fifteen thousand inhabitants, where my observations have been made, I often hear his weird ventriloquistic yelp in the deep-wooded Arroyo Seco, where the wildcat and lynx also roam. He comes boldly up the bordering streets, evading the dogs the best he can; now giving them a wild chase, then stopping in some vacant lot and defying the town, and with head aloft yelping to the moon. At such times, owing to the ventriloquistic qualities referred to, one coyote can create the impression in the mind of a householder or camper that he is surrounded by a pack; the yelps come in such quick succession that they fairly overrun one another and seem echoed back and repeated from every hill, rock, and bluff. In this way a single coyote will arouse the people as he sneaks along, every dog on the alert, yet on the morrow the remains of some plump turkey will be found in the road telling the story of this crafty foeman.

In such trips the coyote is generally alone, and I have met him on the outskirts of the town, slinking home in the early morning, perhaps under the protection of the heavy fog. Often there is a mirage, and at a distance of a few hundred feet Don Coyote looks as large as a sheep looming up in the mist. Generally he stops, turns, and stands a rigid picture for a moment, perhaps wondering what the moving object is, then convinced that it is an enemy, he turns and runs for the Puente Hills with marvelous speed. I give Don Coyote credit for much intelligence, as on one occasion at least he led hounds and horses out of the

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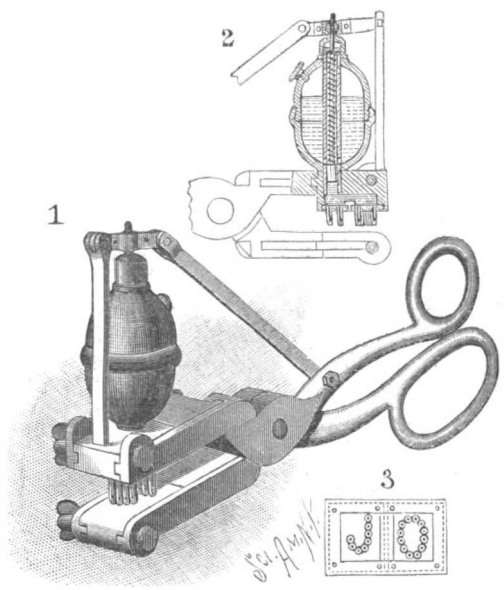
way to a barbed-wire fence, passing under it himself but witnessing the complete demoralization of the hunt as he bounded away.

While the coyote hunts singly in towns or villages, he runs in packs in the open, and it is here that he demonstrates his skill and cunning. A friend of mine observed a pack of coyotes on the edge of the desert manipulating a jack rabbit. They swept across the country in a line, soon starting a hare, then formed in two parallel lines about 200 feet apart. There was a regular plan of action, and none of the coyotes seemed overexcited, but when the hare was started they wheeled into columns like soldiers, the leading coyote running at the top of his speed. After a few moments he dropped to the rear and a fresh coyote took the lead; and this was kept up until the hare was run down.



CAMERON'S BRANDING INSTRUMENT.

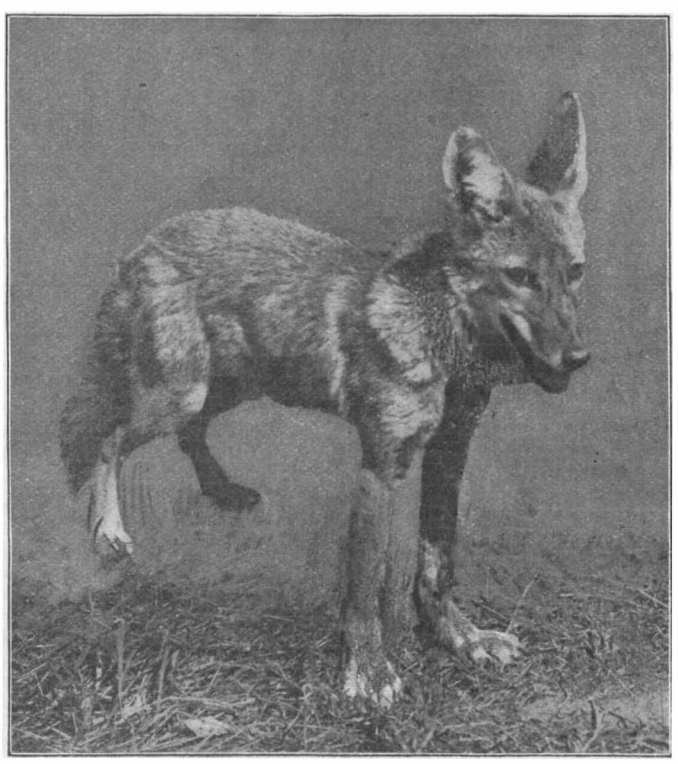
The chase was a silent one. This method recalls the wild dogs of Australia, or dingo.

While the coyote is invariably written down as a coward, and it is true that either singly or in packs he will not attack man or beast larger than himself, when cornered he is a vicious fighter. I have seen one fight off a pack of greyhounds, wounding them so that to save the dogs the hunter was obliged to finish the animal. The coyote in this case had run at least two miles at race-horse speed, and when reached by the hunters was backed up against a rock, snapping his jaws at his crazed antagonist, his teeth sounding like a steel trap as they came together, and taking a piece of flesh whenever they hit the mark.

Seven or eight years ago Southern and Central California abounded in coyotes that to a certain extent annoyed the rancher. A sentiment was gradually worked up against the animal, so successfully, indeed, that the State legislature passed an anti-coyote act, putting a price upon his head or scalp. I had the temerity to oppose this and at the time made several appeals for the animal through local papers and The San Francisco Chronicle, pointing out the reasons. I was evidently in the minority, but time has shown the fallacy of killing all the coyotes, and the act, which bade fair to bankrupt the State, was repealed, and the coyote is once more increasing, though it will be years before he will make the welkin ring as of yore. My argument, especially applied to the localities mentioned, was that as the coyote was the only enemy of the jack rabbit and ground squirrel, his destruction by wholesale would result in a vast increase of rabbits and squirrels. I also pointed out that a scalp bounty in California would open up frauds innumerable, and that coyotes would be exterminated in California, then imported from Arizona, New Mexico and Utah; and this was the case. Coyote killing became so profitable a business that many men devoted themselves to it, and an increase in the pests, jack rabbits and ground squirrels was soon noticed; the law was repealed, but not before the taxpayers of California were looted to a large amount.

The jack rabbit, a famous girdler of young trees and an all-around enemy to the agriculturist, without a redeeming feature, is the natural food of the coyote, which does not disdain the ground squirrel. The coyote is also a snake eater, even attacking the rattlesnake; in a word, he is a valuable scavenger and an animal to be preserved. It is true he has a weakness for turkeys and chickens, and sometimes dines upon small lambs on the edge of large flocks, yet the losses are inconsiderable compared to the ravages the rabbits are guilty of in the San Joaquin and San Gabriel valleys and which they would accomplish if not kept down by the coyote.

Don Coyote can be tamed, and I knew of one instance where a herder kept one that was apparently as tame as a dog. The near allies of the coyote are the maikongs or crab-eating dogs of South America, that hunt in packs and resemble the coyote in appearance. There are several species in South America that call to mind the coyote, as the Guara Canis jubatus, a large, powerful, ferocious dog-wolf five feet in length. Like the coyote, it frequents the lowland countries, especially in Paraguay.



Photograph by Brewster, Ventura, Cal.

THE COYOTE OF THE WESTERN PLAINS.

AN IMPROVED BRANDING INSTRUMENT.

Our illustrations represent an improved device for branding and marking the ears of animals and simultaneously injecting an indelible fluid into the wound. The device has been patented by Walter A. Cameron, Stacey, Mont.

Fig. 1 is a perspective view of the complete instrument; Fig. 2 is a partial section; and Fig. 3 is a cross-section taken just above the marking devices.

The branding instrument consists of two levers pivoted together and provided with jaws. On the lower jaw a soft metal impression block is secured; and on the upper jaw a block is carried, having a chamber communicating by means of a tube with a reservoir containing the indelible fluid. The tube incloses a plunger operated from the upper lever and is provided with lateral ports at its upper and lower ends. The lower ports permit the liquid to flow into the chambered block when the plunger is raised; and the upper ports permit the liquid above the plunger to be forced back into the reservoir.

Symbol-carrying plates (Fig. 3) are removably secured to the chambered block. The symbols consist of letters, figures, or other characters, and are formed of tubular pins.

In using the instrument, the levers are operated to separate the jaws. By reason of this motion, the plunger will be drawn upward to permit the liquid from the reservoir to flow into the chamber. After placing the impression-block carried by the lower jaw against the outer side of the animal's ear, the levers are operated to force the tubular pins into the ear, thereby causing the plunger to inject liquid into the wound.

A spring within the tube holds the plunger normally below the lower ports, so that the liquid will not escape when the device is not in use.

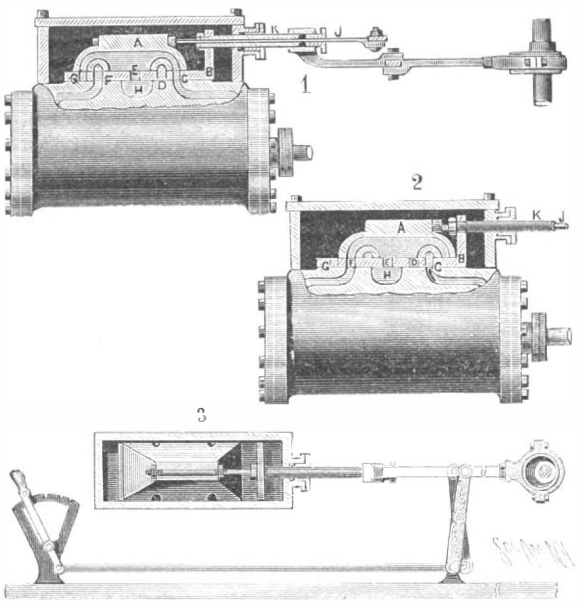
A SIMPLE SLIDE-VALVE FOR STEAM-ENGINES.

The improved slide valve which forms the subject of our engravings consists of two parts, a distributing valve, *A*, and an independently movable section, *B*, interposed between the ports of the cylinder and the distributing-valve, *A*. The distributing-valve is independently adjusted by a stem, *J*, passing through a sleeve, *K*, connected with the slide-section, *B*, and with the eccentric. The sleeve, *K*, is offset in the form of an arm; while the stem, *J*, extends straight through the offset. Two independent connections are thus obtained for working the parts of the compound valve together or separately.

The distributing-valve is formed with a large exhaust-chamber opening inwardly in the middle and through ports near its ends, and with two induction ports opening into the steam-chest to admit steam through the passages, *G*, *F*, *D*, *C*, into the cylinder ports.

The distributing-valve rod, *J*, as shown in Fig. 3, representing a side view of the valve-shifting mechanism, is jointed to the upper end of a lever fulcrumed at its middle to an arm and connected at its lower end with a rod pivoted to an adjusting lever; the upper end of the arm is connected with the eccentric rod.

When the ports are in the position shown in Fig. 1, steam enters through the proper induction opening and passes through *F* and the port communicating therewith into the cylinder, forcing the piston to the right. The steam is expelled through the other cylinder-port, through *C*, through the center exhaust chamber, through *E*, to exhaust, *H*. When the rods are together moved to the right by the eccentric, the valve, *A B*, shifts to the right and the port, *G*, is over the left cylinder port, *D* is over the other cylinder port, and live steam passes through *D* to the cylinder port, forcing the piston to the left; the steam passes out through the left cylinder port, through *G*, to the central exhaust chamber through *E*, to the exhaust, *H*. To reverse the motion of the engine, the relation of the distributing-valve, *A*, and the slide-section, *B*, is changed by means



DAMERELL'S SLIDE-VALVE FOR STEAM-ENGINES.

of the rod, *J*, and sleeve, *K*; for this purpose the distributing valve is slid to the right on the section, *B*, as shown in Fig. 2, by means of the shifting mechanism. As before, the parts, *A* and *B*, are reciprocated by the eccentric; but *G* and C are now changed to live ports and *D* and *F* to exhaust ports, which changes the direction of the engine's motion. The valve is the invention of Henry Damerell, Ludlow, Mo.

THERE are indications that in the near future mercury will be one of the important metallic products of New South Wales. Several tons of ore have been brought to Sydney, and quantities of it distributed among the various government departments, in order that it may be thoroughly tested. Should the results of the experimental plant which is now being built prove satisfactory, the quicksilver trade of the world will become revolutionized, as the poorest assays show the ore to be richer than those of the American and Spanish mines. The subject is considered in the current number of our SUPPLEMENT.

The Current Supplement.

The current SUPPLEMENT No. 1247 has many articles of unusual interest. "The Land of the Boers" is an illustrated paper dealing with some of the interesting scenes in the Transvaal. "A Problem in American Anthropology" is by Prof. F. W. Putnam. "Recent Work Against the Gypsy Moth" describes the wonderful fight which is being waged in Massachusetts against this insect pest. "Experiments with High Frequency Currents at the Charlottenburg Technical Schools" is an article illustrating some curious experiments. "Electrical Propulsion at Tours" is an article describing the Diatto system, which bids fair to rival the underground trolley. Sir William White's splendid address on "Mechanical Science," before the British Association, is concluded in this number. "The Schneider-Canet Naval Turrets" describes the barbette turrets on this system for the ironclad "Marceau." "Report of the Chief of the Bureau of Ordnance" is the annual report of Admiral O'Neil. "American Railroads," by George H. Daniels, is concluded in this number.

Contents.

(Illustrated articles are marked with an asterisk.)

Agriculture, year's progress in ... 346
Armor plating for Russia* ... 344
Artificial paving stones ... 345
Automobile news ... 343
Branding instrument* ... 347
Bureau of Ordnance, report of ... 338
Castner, H. Y.* ... 346
Cruisers, bids for 16½-knot, accepted ... 338
Don Coyote* ... 346
Great Britain, industrial invasion of ... 338
Gypsy moth* ... 345
Inventions recently patented ... 348
Letter box, inventor* ... 340
Lighthouses, new apparatus for ... 340
Locusts, scientific extermination of ... 341
Long scale measuring instruments* ... 345
Meeting Society Naval Architects and Marine Engineers ... 345
Meteor display ... 338
Meteorite collection, Vienna ... 343
Meteor, recording path of ... 345
National Academy of Science, meeting of ... 339
Notes and queries ... 348
Paris Exposition* ... 337, 342
Railroads in Asia ... 338
Rifles, new, for the navy ... 345
Slide valve* ... 347
South Africa, future of ... 342
Submarine boat ... 346
Supplement, current ... 347
Turret for warships, superimposed ... 339
Wireless telegraphy between balloons ... 338

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

POTATO-PLANTER.—Cornelius Honson, Belding, Mich. The planter is adapted either to be drawn by horses or propelled by a motor It opens furrows, drops potatoes in the furrows, and covers the potatoes. The features of novelty are the valve mechanism for conveying the potatoes into the furrows and devices for throwing the valve mechanism into and out of connection with one of the transporting-wheels of the machine. The potatoes are fed preferably by hand and are planted by the machine in two rows of hills, three feet apart.

Bicycle-Appliances.

BICYCLE-SUPPORT.—Samuel M. Miller, Mason City, Ill. The support can be readily attached to any bicycle-frame, and sustains the bicycle after a rider has dismounted. When not required the support may be closely secured to the lower main tube of the frame, out of the path of the pedals. The supporting-rod is prevented from moving or rattling when locked to the frame and, when lowered, is maintained at an angle to one side of the bicycle.

BICYCLE.—Andrew C. Nygaard, Rawlins, Wyo. This is a novel form of chainless bicycle, the pedal-shaft of which is provided with a gear-wheel formed with two series of teeth adapted to engage a double pinion, which transmits the power to the rear wheel. At the option of the driver either series of teeth of the pedal-shaft gear-wheel can be engaged with the corresponding series on the pinion. A change in speed can thus be readily made by the rider, whenever it may be desirable.

SADDLE.—Frederick C. Avery, 6363 Greenwood Avenue, Chicago, Ill. The saddle is of that form having a comparatively rigid seat portion to sustain the weight of the rider, and an elastic pommel. The invention provides a substantial spring with supports to limit the action of the pommel in its up-and-down motion. The tension on the pommel-spring can be so adjusted as to suit the requirements of the rider.

Engineering-Improvements.

BOILER.—Truman Chapman, Concord, N. C. The circulation of this boiler is enhanced and the heating of the water rendered more thorough by means of manifolds communicating with the boiler and connecting with one another by pipes passing through the fire-box and combustion-chamber of the furnace. The arrangement of the tubes insures effective heating and circulation without the necessity of piercing the boiler-shell at a great number of points.

SPEED REGULATOR FOR EXPLOSIVE-ENGINES.—Gustave Victor Léon Chauveau, 163 Avenue Victor Hugo, Paris, France. This valve-operating mechanism for automobile hydrocarbon-motors, comprises a movable part or hook mounted to oscillate and operatively connected with the valve, and an oscillating tappet normally in the same plane as the hook, so that the tappet will engage the hook and actuate the valve. The hook and tappet are relatively movable lengthwise of the axis of oscillation. A governor shifts the parts to cause the tappet to miss the hook in case of an excessive speed. The mechanism is so located as to be examined, lubricated and repaired with more facility than has hitherto been possible.

PISTON-ROD FOR STEAM-PUMPS.—Perry S. Houghton, Lindsey, Penn. The rod has a core of iron or steel, which is provided with annular grooves or recesses. A rod proper formed of brass or bronze incloses the core and is cast integrally around the core and has portions run into the grooves and recesses to form a compact inseparable mass. A piston-rod thus formed is not liable to break, bend, or spring when in use.

Mechanical Devices.

VENDING-MACHINE.—George E. Ford, Room 17, Hermitage, Grand Rapids, Mich. The object of the invention is to provide a coin-operated machine in which the goods to be sold are displayed so that they can be selected by the customer, but without the possibility of their being removed before the proper coin has been deposited. A flexible guard or shield is employed, which is adapted to be manipulated by the hand of a customer and by means of which he is able to select and remove the article he desires, but without actual manual contact therewith and without the possibility of surreptitiously abstracting it. The form of shield used is a pocket or mitten, adapted to receive the operator's hand and to be thrust into the chamber containing the goods.

CARRIER.—Irvin Pribble, Topeka, Kans. The invention is an improvement in overhead carriers and is especially designed for use with dredging-buckets. The carrier runs on cables arranged at an incline. A stop is provided at the lower end of the incline to engage and hold a carrier while the bucket is being lowered to be filled and while it is being raised. The bucket or its supporting device is provided with means which engage the carrier and at the same time release it from its anchoring stop, so it can be drawn up its inclined track to the desired point.

WEIGHT AND PRESSURE RECORDING APPARATUS.—Edward McGarvey, Bellefonte, Penn. The invention provides a simple, electrically-controlled apparatus, by means of which the weight of objects or their pressure can be accurately recorded at any point near to or distant from the weighing-scale and by means of which the time and trouble of manipulating weights and poises are avoided. The weight is taken without perceptible movement of the scale-beam, thus causing little wear on the parts and simplifying the construction. A permanent record of the weight is made, hence there is no liability of mistakes.

WRENCH.—Reinhold Klatt, Strong City, Kans. The shank of the wrench has teeth along its rear edge and a fixed jaw upon which a movable jaw is fitted. A screw-rod is pivotally connected with the movable jaw. A locking-slide separate from the movable jaw surrounds the shank and is provided with a longitudinal opening in which the rod is loosely received and with separated shoulders, A nut is held between the shoulders and screws on the rod. A locking dog on the rear of the slide has a tooth adapted to engage the shank-teeth. A spring-pressed lever pivoted on the slide engages the dog to operate it. The wrench is designed for use on pipes, nuts, and other objects, and can be coarsely and finely adjusted.

BOOK-COVER-SHAPING MACHINE.—Daniel J. Munn, Brooklyn, New York city. The purpose of the invention is to provide a machine designed to give the desired shape to the flexible back of a book-cover before the binding up of the leaves, instead of shaping the back by tools after the insertion of the leaves. The machine comprises a heated former over which the cover-back is stretched. Movable jaws operate in conjunction with the former to engage the cover-back, at the junction of the cover-sides, to form permanent recesses or creases in the back.

EJECTOR FOR BREAKDOWN FIREARMS.—Christian A. Fischer, Grand Forks, N. D. The ejector is designed not to eject a cartridge-shell until the hammers are at full-cock. The ejector-hammer operates in conjunction with a spring-controlled sliding sear and a plunger. A firing-hammer is arranged to operate the plunger; and a spring-controlled trip-rod operated from the plunger is arranged to release the sear from the hammer when the gun is broken.

BRICK-MOLD SANDER.—Elson T. Bennett, Towanda, Penn. In the ordinary brick-mold sander it is necessary to feed the molds into the machine singly, and at the proper time so that there will be no interruption in the feeding. It is also necessary to rap the boxes by hand in order to remove the surplus sand, and to feed the molds by hand. The present invention, so far as possible, renders this work automatic, so that the only hand-work required is the feeding of the molds to the machine. After sanding, the mold is automatically inverted and rapped, whereby the surplus sand is removed. The molds are supplied as may be convenient.

HAIR-PICKING MACHINE.—Edgar Beers, Georgetown, Conn. This machine prepares the hair in sheet form as it comes from the rope without breaking or tearing. The machine comprises a series of feed-rollers, each two pairs of which are operated by a rock-shaft. Pickers operate forward of the feed-rollers and are connected with the rock-shaft by longitudinally-adjustable links. Endless carriers convey the material from one pair of feed-rollers to another. By means of a clutch mechanism, the pickers and feeding devices operated by the shafts may be thrown out of operation when desired.

LIBRARY OR PARCEL CONVEYOR.—Philip Reich, Cincinnati, Ohio. The mission of the library and parcel servitor is automatically to convey books back and forth between their shelves and a central "desk" either upon the same floor or other floors, and simultaneously to register the taking out and return of every book. All this work is performed within a minute by means of conveyers and of electrical circuits connected with a central switch-board. The invention is also adapted for use in insurance and railroad offices, music-publishing houses, and department-stores, where file-boxes or similar parcels are handled. The system dispenses with step-ladders and superfluous help connected therewith. The shelves and desks can be compactly arranged so as to save space and reduce expenses. The invention requires no remodeling of buildings.

Miscellaneous Inventions.

BOTTLE.—Philip J. Friedrich, Coytesville, N. J. This non-refillable bottle is fitted with a simple means to prevent the outflow of liquid should the bottle be inverted. This means is also designed to act as a stopper or valve to relieve the main valve of the pressure of any small amount of liquid which might be in the bottle, during an attempt to refill by inverting the bottle in liquid. A tube permits the entrance of air while pouring liquid from the bottle, the tube being provided with a valve to prevent refilling therethrough.

AMALGAMATOR.—John M. Holmes, Glens Falls, N. Y. The amalgamator comprises a pulverizing-drum with an inner and an outer sheet-metal shell, the inner one being corrugated to provide a series of ribs. A mulling-cylinder longitudinally corrugated is arranged within the inner shell and is adapted to engage with its corrugations, whereby the rotation of the shell will cause the cylinder to revolve. Steam is directed through the peripheral passages formed by the corrugations of the inner shell. The corrugations form a series of heating-tubes and take the place of gear-teeth.

WATER-FEED APPARATUS.—John Morrison, Dubuque, Iowa. The object of this invention is to provide a stock watering-trough in which the water will be kept warm in winter. A large tank provided with a suitable heater contains near its bottom a small reservoir which is connected through the side of the tank by means of three hollow bolts—two at the top and one at the bottom—with a watering-trough. The uppermost of the three bolts, which is above the water level, serves to keep the water in the reservoir at atmospheric pressure. An automatic float valve admits water to the reservoir when the level is lowered, and a constant circulation of warm water into the trough is maintained through the other hollow bolts.

Designs.

BOTTLE.—John Schies, Anderson, Ind. The bottle is triangularly shaped in cross-section, being made up of broad flat sides or panels, with narrow panels breaking the angles between them. The broad panels converge to a point at their top, while the narrow panels diverge to correspond. The neck of the bottle is cylindrical, having a rib about midway between its ends and a shoulder at its juncture with the body.

COVER-DISH.—Robert L. Johnson, Hanley, England. The leading features of the design consist of fluted undulating side panels on the body and cover and embossed curtain end panels separating them. The minor features consist of foliate handles on the body and cover and fancy border ornamentation on the same.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7761) M. F. K. asks: 1. What resistance is necessary in a 52 volt current of say 5 amperes, to reduce the voltage to 4, 6, and 10 volts respectively and what rule is applicable in such a case? A. This problem is solved by Ohm's law C=E÷R or CR=E. In this case C=5, and E=52. Then R=10·4 ohms; 5 amperes will flow when the resistance in the circuit is 10·4 ohms. Now to find the point from which to the other pole the drop will be 4 volts. The drop through the rest of the circuit must then be 48 volts. Solve as before with 48 in place of 52. The result is 9·6 ohms. With 9 6 ohms in the external resistance the drop in the rest of the circuit is 4 volts. Proceeding in the same way for 6 volts, you will find 9·2 ohms; and with 10 volts, 8·4 ohms as the resistance required. 2. If a wire is connected to the two wires of a 52 volt multiple circuit, it causes a short circuit; why does not an incandescent lamp cause the same result? A. The resistance of the lamp is high enough to allow the proper current to flow for heating the filament to incandescence only, but the resistance of the wire is so low that a current flows which is able to heat the wire above its melting point. If a piece of wire were taken which has the same resistance as the lamp filament, there would be no burning out of the wire.

(7762) J. A. K. asks: 1. Will you kindly inform me of a simple method to take fluoride of ammonia, the crystals, and treat it so as to contain a small portion of hydrofluoric acid? Then dry all so as to form powder or nearly so. A. If you heat fluoride of ammonium mixed with sulphuric acid in a dish of platinum or lead, you will produce the hydrofluoric acid which we understand you to mean. You must not do this where any of the fumes can be inhaled by any one. You cannot dry the result since this acid absorbs water most greedily. Nor can the acid be kept except in lead or hard rubber bottles. It is highly corrosive and very dangerous to have around. 2. What is the best fatty oil to dissolve resin in so it will not become too tacky? A. Turpentine is the best solvent of resin. A mixture of turpentine and kerosene may be so proportioned with resin as to make a non-tacky compound.

(7763) M. C. asks: 1. In regard to the record of the gramophone I wish to know if sound could be reproduced from the zinc disk on which the sound wave is first etched, as well as from the ordinary record which is made from the zinc disk? A. Yes, except that there would be a metallic, harsh quality given to the sound by the scraping of the stylus over the zinc. 2. Is the record made directly from the zinc disk or is it made from a mould which is made from the zinc disk? As for instance, in stereotyping, a mould is first made from the type and the plate is then made from the mould. A. The record must be made from the mould which has been made from the zinc disk. A copy from the zinc directly is the intaglio of the original, and reverses its tracing completely. It could not be employed for reproducing the original sound.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

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AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.

Advertising apparatus, G. L. Farwell 636,783
Agricultural implement, E. E. Whipple 636,878. 637,190
Air brake, M. Corrington 636,954
Air brake, J. Shourek 636,858
Air brake hose coupling, automatic, H. E. Parkinson 637,021
Air compressor, hydraulic, L. E. Mitchell 637,144
Alarm. See Bicycle alarm. Burglar alarm.
Alarm system, electric, R. R. May 636,910
Animal trap, J. J. Johnson 636,901
Animal trap, W. S. Vankirk 636,870
Apparel, balanced floating, G. D. Burton 636,893
Axle and axle box, Wells & Morrill 636,876
Axle box, R. R. Cross 636,955
Axle, vehicle, H. C. Jones 636,807
Back pedaling brake, Stem & Dunlap 637,178
Bag fastener, P. M. Bang 637,068
Bandage, J. N. Armstrong 636,742
Barrel closure, H. A. McEachern 637,151
Batteries, manufacture of electric, E. Baines 636,938
Battery compound, electric, H. Blumenberg, Jr. 637,071
Battery cups, making, F. G. Curtis 636,956
Beam shoe, W. C. Hanna, Jr 636,982
Bearing, antifriction, J. S. Oram 637,016
Bearing, ball, F. H. Heath 637,204, 637,206
Bearing for cycles, ball, F. H. Heath 637,205
Bedstead, iron folding, J. Montgomery 637,146
Bell, bicycle, E. Ericson 636,966
Belt guide, E. Cayemberg 636,951
Bicycle, O. H. Gentry 636,792
Bicycle, H. H. Pattee 636,921
Bicycle alarm, D. Nei 636,833
Bicycle brake, G. N. Chase 637,085
Bicycle brake, C. L. Kindsfatter 637,128
Bin. See Ore bin.
Bit. See Bridle bit.
Boat, G. M. Waters 637,052
Boat bottom grating, L. Cailleaud 637,080
Boiler. See Locomotive boiler. Steam boiler.
Boiler, B. W. Rice 636,923
Boiler safety plug, steam, C. E. Rhoades 636,845
Bolt fastener, J. Marx 637,141
Book, manifold sales, G. E. Doughty 637,094
Bottle or jar stopper, C. R. G. Hovermann 636,801
Bottle stopper and sprinkler, combined, W. W. Lowrey 636,821
Bottle washing machine, W. T. Hawkins 636,985
Box. See Cartridge box. Coin box. Collapsible box. Hat packing box.
Brace. See Corner brace.
Brake. See Air brake. Back pedaling brake. Bicycle brake.
Brake, L. Kintz 637,003
Brake beam, T. E. Carliss 636,755
Brake shoe bracket, W. H. Ryer 636,853
Brake slack take up, J. C. Wands 636,874
Bridge, M. Waddell 637,050
Bridle bit, G. E. Smith 637,170
Broom holder, Hughes & Munger 637,208
Bucket, dinner, G. Herburger 636,988
Bundling machine, Hindley & Harding 637,207
Burglar alarm, electric G. McGann 637,012
Burial apparatus, E. B. Voorhees 636,933
Burner. See Liquid fuel burner.
Button, G. W. Dover 636,960
Button, collar, W. O. Wheeler 637,189
Cabinet and safe, D. N. Shoemaker 637,168
Cacao butter, extracting, A. C. M. Rieck 636,849
Caisson, mining, A. F. Lucas 637,137
Calcium oxid, treating, C. Straub 636,865
Calculating machine, G. & R. Schwarz 637,167
Camera, magazine, N. E. Marchand 636,823
Cant hook, C. Prouty 637,157
Caps for explosive charges, device for applying protectors to fulminating, W. E. Miller 636,919
Car coupling, T. Cusick 636,957
Car coupling, V. Erbach 637,099
Car coupling, B. Milch 636,827
Car door operating mechanism, freight, A. E. Witt 636,880
Car grip, coal, M. Jolliffe 636,904
Car roof, E. C. Ewing 636,781
Car switch, S. Parson 637,154
Car switch operating attachment, S. Parson 637,155
Car washing apparatus, C. L. Kline 636,906
Cars, electrical bell ringer for street, Enz & Fetter 636,779
Carbureter, B. C. J. Anderson 637,062
Card shuffling machine, J. M. Bowden 636,749
Cardboard from leather stuff, manufacture of, G. Brigalant 637,074
Carpet fastener, W. E. Woozley 637,193
Carriage fan attachment, baby, Dammen & Bergquist 636,898
Carrier trip head, J. Ney 636,834
Cartridge box, F. M. Garland 636,978
Case. See Filing case.
Casket, R. C. Davis 636,766
Caster, T. Byers 637,079
Caster, ball, E. P. H. Carraway 636,757
Casting aluminum alloys, W. A. McAdams (reissue) ..... 11,788 to 11,790
Casting apparatus, blast furnace, F. E. Bachman 636,885
Catalytic material, M. Schroeder 636,925
Cement, C. F. Lawton et al 637,211
Cement, plaster, etc., composition for, C. Straub. 636,866
Centrifugal machine, Evans & Goldsworthy 636,780
Chain sprocket, C. E. Whitney 637,056
Chair with automatically changing seat, F. Beil 636,745
Checkrein hook, J. L. Simpson 636,927
Cheese moulding machine, J. B. Pecht 636,839
Chuck bone holder, J. W. Markey 636,824
Churn, J. B. Neuendorff 637,014
Cider mill, F. Wayland 637,188
Cigar bunching machine filler feeding device, A. Du Brul 636,961
Cigar making machine, F. Haehnel 636,981
Clay or gravel washing machine, Horr & Gibbons 636,995
Clock, secondary electric, J. J. Stockall, Sr 637,179
Cloth cutter, C. A. Jackson 636,998
Cock, J. H. Lieber 636,819
Coffee roaster, L. T. Eanes 637,097
Coin box, C. B. Bishop 636,947
Collapsible box, lock bottom and top, G. L. Johnstone 636,806
Collar and shirt protector, G. W. Stauffer 636,864
Collar, horse, L. Hansen 636,798
Composing machine, J. D. C. Chateau 637,086
Confectionery, charging mechanism for coating, W. H. Weeks 637,053
Conveyer, screen, O. J. Conley 636,762
Conveying apparatus, J. G. Delaney 636,768
Conveying apparatus, T. S. Miller 637,142, 637,143
Cooling apparatus, L. Bell ..... 636,886 to 636,888
Corn husking machine, M. Young 637,194
Corn, separating germ from, J. F. Phillips 637,029
Corner brace, W. W. Sherwin 637,217
Cotton picker's spring spine supporter, S. C. Potts 637,156
Coupling. See Air brake hose coupling. Car coupling. Thill coupling. Wagon coupling. Whiffletree coupling.
Crate, knockdown and collapsible, W. R. Ambrose 637,061
Creamer, centrifugal, J. J. Berrigan 637,070
Crushing and pulverizing machine, W. B. Folsom 637,076
Cryptographic chart, W. C. Van Horn 637,049
Cuff supporter, P. E. Daniels 636,765
Cultivator, D. G. Burkhart 636,753
Cultivator and handle therefor, G. C. Avery 636,743
Cupel machine, A. C. Calkins 637,081
Curling tongs heater, J. C. Forsberg 636,785
Curtain, A. A. Frankl 636,787
Curtain stretcher, lace, J. Klemenz 636,812
Cutter. See Cloth cutter.
Cycle lock, J. D. Amenabar 636,740

(Continued on page 349.)

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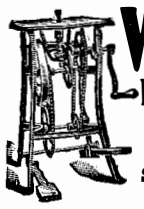

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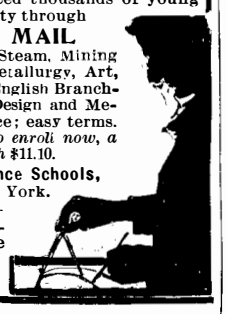

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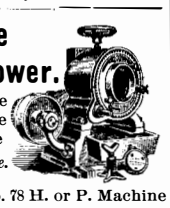

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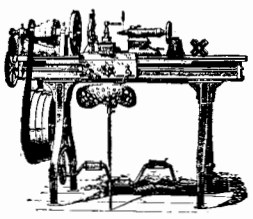

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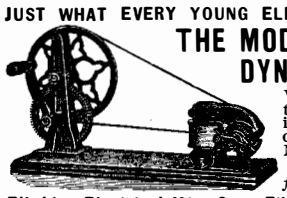

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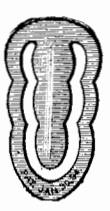

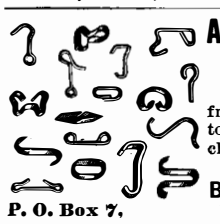

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Dental impression tray cooling attachment, A. M. Jackson	637,123
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Disintegrating animal matter, apparatus for, J. Chase	636,759
Displaying ribbons, laces, etc., cabinet for, G. W. Haddox	637,203
Door, J. M. Leaver	636,817
Door opening or closing device, A. P. Lipinski	636,820
Door, sliding, J. Ewald	637,104
Draught equalizer, J. L. Owens	636,838
Drawing roll clearer, C. E. Smith	637,040
Dredging apparatus, J. Edwards	636,775
Dredging vessel, J. Edwards	636,774
Drier, W. B. Ruggles	636,852
Drier, Snyder & Seldner	636,928
Drinking glass registering attachment, J Kreutzmann	636,815
Dust pan, E. C. Rose	637,162
Dye, yellow basic, Terrisse & Darier	637,183
Ejector, J. L. Chapman	636,955
Electric band, J. M. Wolkosky	636,881
Electric battery, Blumenberg & Overbury	637,072
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Electric switch, quick break, R. B. Hewson	636,989
Electric switch, quick break, G. L. Holton	636,804
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Electric wires or cables, safety contact interrupter for suspended, R. Ducornot	637,096
Electricity from car wheel axles, means for generating, P. Eggleston	636,776
Elevating, transporting, and discharging material, apparatus for, O. Johnson	636,902
Elliptic spring, C. A. Miller	636,828
Engine. See Fluid pressure engine. Rotary engine. Steam engine.	
Engines, apparatus for preventing water blows in steam, A. Cejka	636,894
Extractor. See Stopper extractor.	
Eyeglass or spectacle case, H. E. Kirstein	636,811
Eyeglasses, H. Fennell	637,109
Fan motor, ceiling, H. H. Wait	636,871
Fan or paddle wheel, rotary, W. J. Fitch	637,105
Fats, refining, Klimont & Nagel	637,131
Faucet, A. Engel	636,777
Faucets, fluid drawer and means for attaching same to, C. H. Bradley	636,751
Fence machine, slat and wire, M. Plummer	636,840
Fence post attachment, W. H. Sawyer	636,855
Fences, implement for applying wires to wire, J. W. Connelly	636,763
Fender. See Vehicle fender.	
Filing case, E. G. Richards	637,033
Filter, water, E. T. Dreier	637,095
Firearm, breech loading, W. L. Stockwell	637,043
Fire escape, L. N. Duquette	636,771
Fireman's apparatus for saving life, W. E. Harris	636,984
Floor and ceiling plate, A. J. Beaton	636,943
Floor cloth, composition for making, F. Gatzsche	637,106
Fluid pressure engine, L. Serpollet	636,926
Flume and water outlet therefor, J. A. Blake	636,747
Forging and sharpening machine, drill, W. J. Evans	637,102
Fountain. See Ornamental fountain.	
Frame junction, E. Taylor	637,046
Furnace for heating soldering irons, G. Bickelhaupt	637,198
Furnace grate, Green & Gent	637,108
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(Continued on page 350.)

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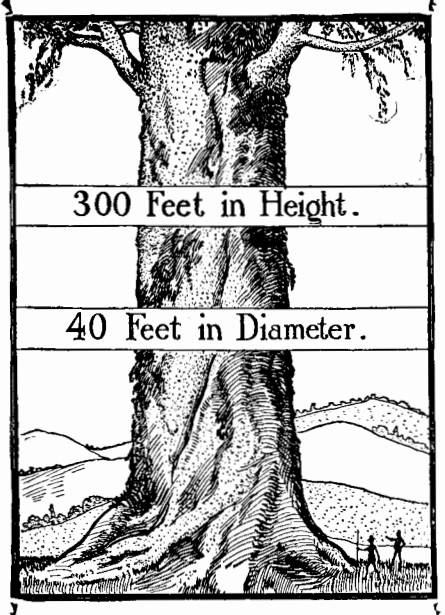

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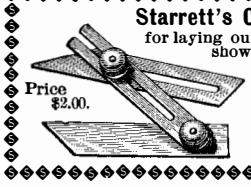

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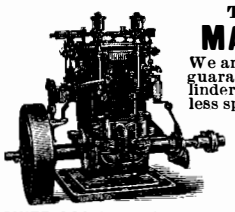

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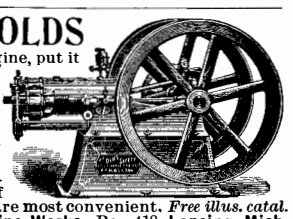

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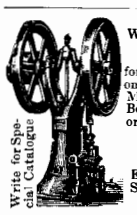

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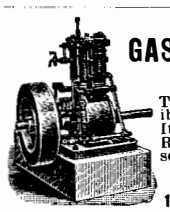

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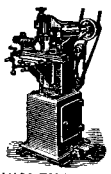

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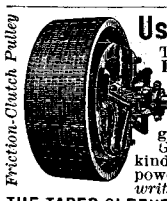

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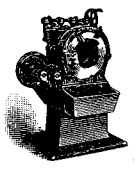

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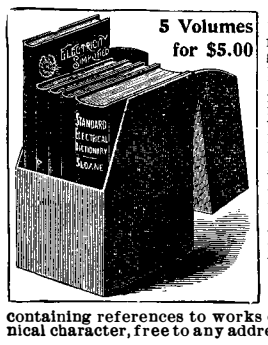

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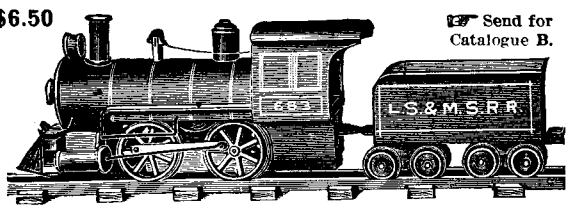

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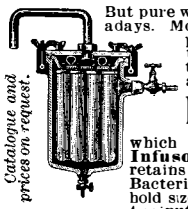

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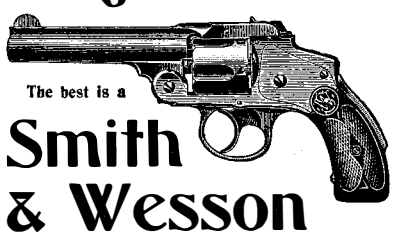

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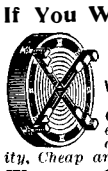

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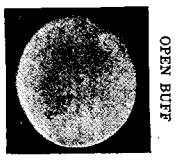

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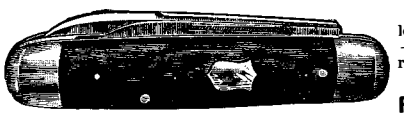

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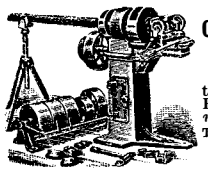

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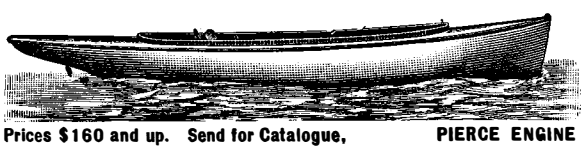

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Lieut. Peary's Adventures.

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RUDYARD KIPLING

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ANTHONY HOPE

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MARK TWAIN

has written several papers for coming numbers. "My Boyhood Dreams" will appear in the January number.

BRET HARTE

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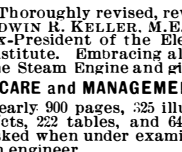

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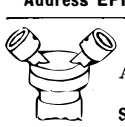

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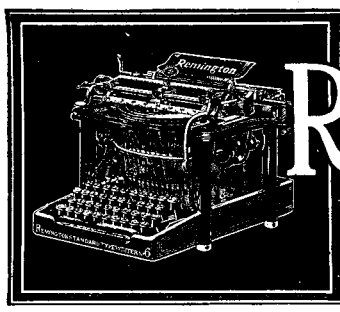

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PROPOSALS.

COMMISSION NEW EAST RIVER BRIDGE,
City of New York.

NOTICE TO CONTRACTORS.

November 9, 1899.

Proposals will be received by the Commissioners of the New East River Bridge, at their office, at No. 49 Chambers Street, in the Borough of Manhattan, in the City of New York, at two o'clock in the afternoon of the 7TH DAY OF DECEMBER, 1899, endorsed "Proposal for Construction of Steel Cables, Suspenders, etc., of the New East River Bridge," for furnishing the materials for and constructing the steel cables, suspenders, cable bands, coverings, sheaves and their appurtenances of the New East River Bridge, in accordance with the proposed form of contract and the drawings and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to Lewis Nixon, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the said Commissioners on that day at two o'clock in the afternoon.

Copies of the specifications and the general drawings for the work, with the proposed forms for the bid, bond and contract, may be seen and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Borough of Brooklyn, City of New York, on and after the 13th day of November, 1899.

The Commissioners require that all bidders shall carefully examine the specifications, drawings and proposed form of contract, in order that no question as to their meaning may arise hereafter. It must be distinctly understood that no changes in the quality of the materials or of the workmanship will be allowed, and that the specifications will be adhered to strictly.

The contract is to be completely performed within ten months after the cable saddles are set in place upon the steel towers of the bridge.

Proposals will be made upon a form provided therefor, and only those proposals will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal in the office of the Commissioners, a certified check for $12,000, payable to the order of Julian D. Fairchild, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract and the giving of the required bond, if his bid is accepted, within two weeks after notice of the acceptance of his bid.

The Contractor will be required to give a bond in the penal sum of $400,000, in the form annexed to the proposed form of contract, with an approved surety company doing business in the City of New York, conditioned for the prompt and faithful performance of the contract and its covenants and the work thereunder.

As by far the greater part of this work can be executed only by bridge establishments of the first class, bids will be received only from such parties as have the requisite plant and facilities which have been in successful operation on work of similar character for at least one year. The bidders must be, in the opinion of the Commissioners, fully qualified both by experience and in appliances to execute work of this character and importance according to the highest standard of such work at the present time.

The Commissioners reserve the right to reject any and all of the proposals offered, and to accept any proposal offered.

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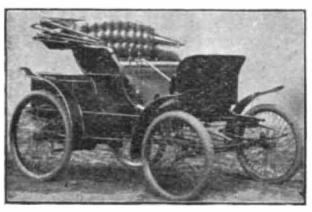

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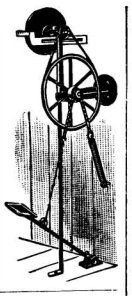

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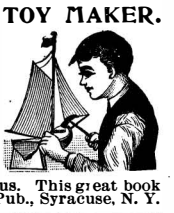

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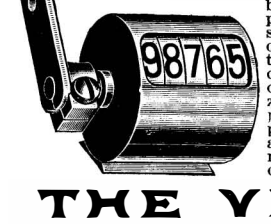

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